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CONTENTS

Clinic of Dr. Arthur Dean Bevan, *Presbyterian Hospital* PAGE

x-Ray Burns 935
Two Cases Operated on Under Local Anesthesia—One an Acute Appendicitis and the Other a Carcinoma of the Pyloric End of the Stomach 945
Two Cases of Mediastinal Tumor which Proved to be Substernal Thyroid Enlargements 957

Clinic of Dr. Allen B. Kanavel, *Wesley Memorial Hospital*

Splenectomy under Local Anesthesia in a Greatly Debilitated Patient 965
Laminectomy 973

Clinic of Drs. Albert J. Ochsner and John Nuzum, *Augustana Hospital*

Ligation of the Inferior Thyroid Artery and Vein According to the Method Introduced by Professor Dequervain. The Use of Local Anesthesia in These Operations and in Thyroidectomy 981

Clinic of Dr. Joseph B. DeLee, *Chicago Lying-in Hospital*

Acute Appendicitis in Pregnancy at Term 1003

Clinic of Dr. Herman L. Kretschmer, *Presbyterian Hospital*

Hypernephroma of Right Kidney 1013

Clinic of Dr. Daniel N. Eisendrath, *Cook County Hospital*

The Lymphatics of the Female Breast in Relation to Carcinoma of the Breast .. 1025
A Case of Umbilical Fistula 1037

Clinic of Dr. Carl B. Davis, *Presbyterian Hospital*

Tumors of the Large Bowel. Presentation of a Group of Cases Illustrating Typical and Atypical Pathology in Tumors of the Large Bowel 1047

Clinic of Dr. Charles A. Parker, *Home for Destitute Crippled Children (Out-patient Department)*

A Series of Orthopedic Cases 1069

Clinic of Dr. Albert E. Halstead, *St. Luke's Hospital*

Ileocolic Intussusception Protruding Through the Anus: Operation and Recovery 1083
Pylephlebitis of Appendical Origin Simulating Lung Abscess 1093

Clinic of Dr. David C. Straus, *Cook County Hospital*

Amputation of the Thigh with Demonstration of 3 Cases Presenting Uncommon Indications for its Performance 1113

Clinic of Dr. Edward Lyman Cornell, *Chicago Lying-in Hospital*

Transperitoneal Cesarean Section 1157

Clinic of Dr. Ralph Boerne Bettman, *Michael Reese Hospital*

The Removal of Embedded Needles in Broad Daylight with Intermittent Fluoroscopic Control 1163

Clinic of Drs. Gatewood and L. C. Gatewood, *Presbyterian Hospital*

Syphilis of the Stomach 1175

Clinic of Drs. E. Wyllys and Edmund Andrews, *St. Luke's Hospital*

Two Cases of Laminectomy in the Lumbar Region for Traumatic Paraplegia 1185
Extraperitoneal Drainage of a Cholecystectomy Wound 1197

Clinic of Drs. Edward Louis and Louis D. Moorhead, *Mercy Hospital*

Wry-neck: Two Cases—One Congenital, the Other Acquired 1203

Clinic of Drs. Carl Beck and Verne S. Cabot, *North Chicago Hospital*

Lipoma Arborescens of Ankle-joint 1213
Partial Necrosis of Coccyx Due to Injury Two Years Prior to Operation 1215
Biliary Fistula and Cholecystectomy 1217
Plastic Operation for Treatment of Large Empyema Cavity 1219
Postoperative Appendical Fecal Fistula 1227

THE SURGICAL CLINICS
OF
NORTH AMERICA

VOLUME 1 NUMBER 4

CLINIC OF DR. ARTHUR DEAN BEVAN

Presbyterian Hospital

x-RAY BURNS

Summary: Presentation of 2 patients with *x*-ray burns of the leg, one following treatment for psoriasis and the other for eczema. Treatment of burn by removal of damaged tissue and skin-grafting. Results very gratifying following this method.

One of the most important of the unusual problems that have presented themselves in the last twenty-five years since the discovery by Roentgen of the *x*-ray has been the subject of *x*-ray burns. Fortunately, I am able to show you 2 of these cases this morning. I shall operate upon one; the other I operated upon several weeks ago, and I can present the case to you and give you the history and show you the result.

A few months after Roentgen's announcement of the discovery of the *x*-ray one of my friends here in Chicago, Dr. Otto L. Schmidt, developed at a good deal of expense an *x*-ray laboratory and placed it in charge of Mr. Fuchs. Dr. Schmidt deserves a great deal of credit for doing some of the pioneer work in this country with the *x*-ray and enabling us here in Chicago to familiarize ourselves very early with the use of the *x*-ray both as a means of diagnosis and as a means of treatment. In fact, Chicago was at the beginning the hot-bed in which much of the early *x*-ray work in America was done. For instance, we did here the first work in the use of this agent as a means of diagnosis in kidney stone. Dr. William Allen Pusey, of Chicago, and one of my associates, Dr. Joseph F. Smith, now of Wausau, Wisconsin, did some of the earliest work with the *x*-ray as a means of treatment in lupus vulgaris and, as you all know, Dr. Pusey and Dr. James Nevins Hyde and his associates, Dr. Montgomery and Dr. Oliver S. Ormsby, have done pioneer work and exceptionally good work in the use of the *x*-ray in epithelioma and in skin lesions. Dr. Nicholas Senn was one of the earliest men to use the *x*-ray in leukemia and in Hodgkin's disease.

Immediately following the introduction of *x*-ray work it was first noted that it would produce a falling out of the hair of the beard or scalp. Very shortly afterward serious burns from the use of the *x*-ray began to be reported. Within the first few weeks of the use of the *x*-ray in Dr. Schmidt's laboratory several serious burns were produced, some of which led to malpractice suits, and were tried out in court. It was unfortunate that in some of these cases, in spite of the good intentions of the men using the *x*-ray and their lack of knowledge of its destructive effects, juries returned verdicts for the plaintiffs in these lawsuits. Of course, the early use of the *x*-ray was rather crude, and we were ignorant of many of the facts which are now clearly understood. We are at present in a position where we can speak with considerable knowledge in regard to the destructive effects of the *x*-rays and in regard to the serious consequence of *x*-ray dermatitis with resulting carcinoma and *x*-ray burns with greater or less destruction of tissue. Mr. Fuchs, who began the work in Dr. Schmidt's laboratory, developed very early a dermatitis, and later, as did many of these *x*-ray operators, died of carcinoma.

To many of you this may seem an old story, and yet some of the younger men who did not live through this period do not realize the risks that these early *x*-ray technicians ran. I do not think it an exaggeration to say that most of the early *x*-ray technicians died of carcinoma developing in *x*-ray dermatitis lesions of their hands. The experts of today realize these dangers and protect themselves against dermatitis and against producing *x*-ray burns in their patients in large part, although I still occasionally see an *x*-ray burn that has occurred in the hands of an expert. Unfortunately, many of the men using *x*-ray machines today are not experts and are not familiar with the risks and dangers, and x-ray burns are, therefore, still common and occur largely in the hands of these men.

In the case we shall operate on this morning a young man of twenty-five was treated for psoriasis of the leg with the x-ray and, unfortunately, received very massive treatment, which resulted in producing an x-ray burn about 5 or 6 inches long and about 3 inches wide, over the anterior surface of the leg about midway between the knee and the ankle. At first it seemed as though this was not very deep, and it finally, under careful treatment, very slowly healed up, leaving an area of low vitality, but which finally entirely covered over with thin epidermis and scar tissue. A couple of months ago he bruised this scar and it broke down, became quite painful, and gradually extended into a large slough about 4 or 5 inches long and 3 inches wide. This case came into the hands of a colleague of mine, and some weeks ago he brought him to my service. I advised operation, dissecting out of the tissue that had been damaged by the burn, and skin-grafting of the area. The man had pain in the burn, as most of these patients have. In his particular case the pain was not as severe as usual, but for several weeks he has been taking small doses of morphin to control the pain. He has lost weight and strength, and he is very nervous and mentally depressed because of his condition.

We shall do this operation under a general anesthetic and select ether for that purpose. The left thigh has been prepared so that we can take the skin-grafts from the same limb as the burn, which I think, as a rule, is a good thing, leaving one limb perfectly free from bandages or dressings. This gives the patient, I think, as a rule, more comfort than to put both limbs out of function by the operation. You will notice that there is a thick scab covering this area, a dark brown and dry scab. Underneath this is some pus. I begin my dissection going very wide of the damaged skin, at least $\frac{2}{3}$ inch outside of the destroyed skin. I think it is the safer plan to do this because my experience has been that if I make the dissection too close to the damaged area we may leave some tissue which is not grossly involved, but which heals very slowly. As I raise up this dis-

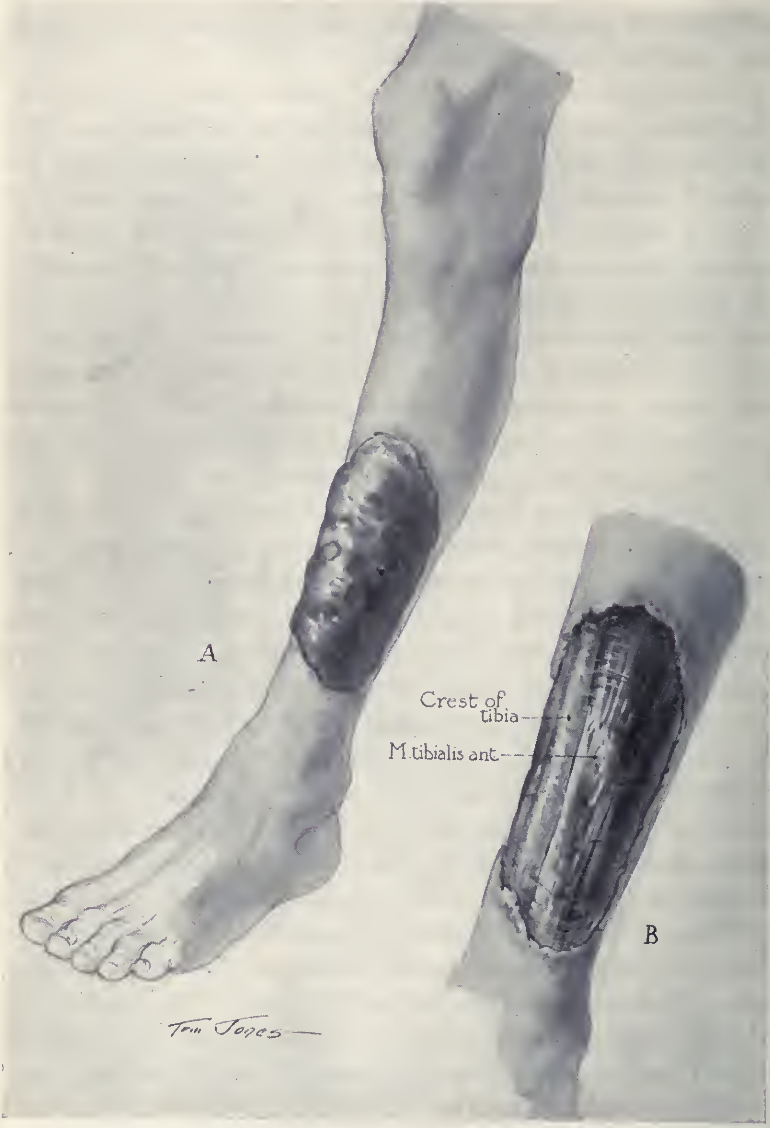

Fig. 390.—A, *x*-Ray burn of leg. A large gangrenous area is somewhat elevated by a bed of pus. B, After excision of entire necrotic area. Note exposure of tendons and the anterior surface of tibia.

section you will notice that the scab and the destroyed area go down very deeply, involving not only the skin but the superficial fascia and the deep fascia, and a thin layer of muscles on the anterior layer of the leg. I dissect this up very carefully and finally remove in one block of tissue all of the damaged structures. From some standpoints it would be better to cover this large area with a flap of the entire thickness of the skin and superficial fascia, making a pedicled flap, taking it from the other limb. I have found, however, that covering these areas with good Thiersch grafts as a rule gives excellent results, and is, on the whole, very much simpler and more satisfactory. My dissection now leaves an area about 7 inches long and 4 inches wide. You will notice that we have exposed not only the anterior group of muscles of the leg, but that the destruction also involved the periosteum on the anterior surface of the tibia, which comes out with this large eschar we have removed. I also uncovered the peronei muscles on the outer side of the leg in the dissection.

Beginning now with our skin-grafting, I split the thickness of the skin of the thigh by a sawing motion with a very sharp razor ground perfectly flat on one side. The first ribbon, as you see, is about 2 inches wide and about 4 inches long. This is accurately placed on the exposed area of the anterior group of muscles and one after the other. As you see, it is necessary for me to cut five good-sized ribbons of half the thickness of the skin in order to close the area completely. I now cover these skin-grafts with one thickness of gauze very carefully applied. I can see through it as one can see through a veil, and see that I have brought the gauze flatly and smoothly against the skin-grafts and keep them very accurately in contact with the raw surface. Over this I now place several thicknesses of sterile gauze and over this a sterile gauze roller about 5 inches in width. Over this again I put on a starch bandage covering the entire dressing and allow the starch to dry and to fix the dressing accurately in position. This dressing will be left on for four or five days if there is no reaction, and then very carefully removed, so as not to lift the grafts up from their bed.

I shall now show you the second patient upon whom we operated about three weeks ago and give you the history of this case, and use this other patient as a means of describing fully the after-management in these cases and the after-history.

This patient, a lady of seventy, a patient of Dr. Ormsby, was treated with the *x*-ray for eczema of the leg and, unfortunately, in someone's hands, not Dr. Ormsby's, received a very severe burn about 5 inches long and about 2½ inches wide on the anterior surface of the leg in about the same position as this patient. She has kindly consented to allow me to show you this case. This patient has been bedridden for a great many months on account of this burn, principally on account of the severe pain which she has been experiencing. I want to discuss the pain of an *x*-ray burn with you because it is one of the most important features. The pain of an *x*-ray burn seems to me to be very much like the pain in senile gangrene due to obliteration of the blood-vessels and starving of the nerves of their normal supply. The pathology of the two processes is fundamentally the same because in an *x*-ray burn the essential thing is the gradual obliteration of the blood-vessels, and where necrosis occurs it is due to the fact that obliteration of the blood-vessels is so complete as to no longer supply the necessary amount of blood to the part. The pain of an *x*-ray burn is, as a rule, very severe and sometimes excruciating. In many of the cases the patients become users of morphin, driven to it by the severe pain. In several cases where we have had *x*-ray burns about the anus, produced in the efforts to cure pruritus ani, the pain has been agonizing, especially when the patient had a bowel movement, and at this time sometimes requiring 1 grain or 2 grains of morphin to control the pain and to permit of a bowel movement. There is one very characteristic thing about this condition, and that is, as soon as we dissect out completely the tissue damaged by the *x*-ray the pain almost at once disappears. I have had many patients make that statement to me, and that is confirmed also by the striking fact that many of these patients who have been taking considerable amounts of morphin are quite willing to very soon discontinue completely the use of the narcotic.

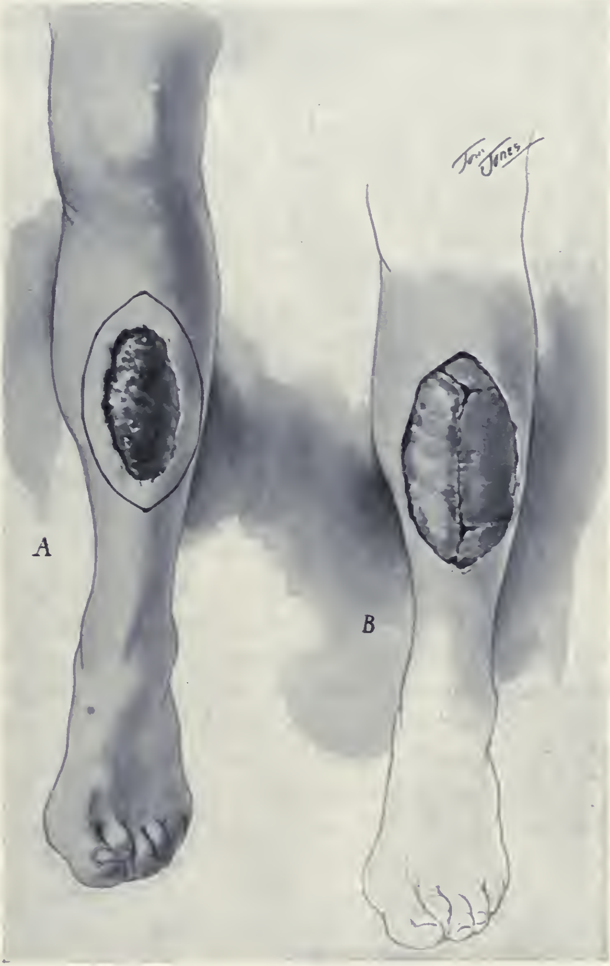

Fig. 391.—*x*-Ray burn of leg. Note wide excision of entire area and the application of large Thiersch grafts.

In this lady's case we did the operation under ether, and in exactly the same way as you have witnessed this morning. The immediate effect was the relief from pain, and in spite of the fact that she was in an extremely nervous condition owing to her long confinement (she had been in bed more than four months on account of the burn) she expressed herself as being most grateful for the relief from the pain that the operation had afforded. At the end of a week I made the first dressing, and found that all of the grafts had taken. Now you will see at the end of three weeks the entire area is perfectly healed, there still being simply at the margins narrow scabs covering the junction of the grafts and the line of the incision, and also two narrow scabs running up and down the area marking the position of the junction of the two skin-grafts.

This patient had not walked for more than four months, and on account of the pain had kept the right limb, the damaged limb, perfectly quiet during that time and obtained a very marked fibrous ankylosis of the knee as a result. It was with difficulty that I could encourage her to bend the limb and to attempt to use it in walking, but she is now able to move the limb and able to walk with the assistance of a nurse, gradually recovering her strength and weight, and within a short time will be able to leave the hospital.

Nothing is more gratifying than a case such as this where we can relieve the patient of a serious condition such as an *x*-ray burn by completely removing the damaged area, and are able to cover the raw surface from which the destroyed tissue is removed with normal skin, and obtain good, complete wound healing, with resulting freedom from pain and return of function. I think, as a rule, where the *x*-ray burn is serious you will save a great deal of time instead of handling the case, as is frequently done for months with various dressings and salves, if you will as soon as you recognize the fact that a certain portion of the skin is so much damaged that it cannot repair itself, take radical steps and remove the damaged tissue and cover the area by skin-grafts.

We have, fortunately or unfortunately, on our service handled probably from 25 to 30 of these *x*-ray burns in a series of years. In a few cases we have seen carcinoma develop in the damaged area. I am inclined to think, however, from my knowledge of the subject and from my own personal experience that epithelioma is not as apt to develop in tissue that is so greatly damaged by the *x*-ray that it completely loses its vitality as it is in the minor lesions which are classified as *x*-ray dermatitis. In a large series of *x*-ray burns I can remember but 3 epitheliomas that have developed in these lesions. On the other hand, the cases of *x*-ray dermatitis which I have seen in the hands of *x*-ray technicians have in the majority of cases ultimately resulted in carcinoma.

Do not these cases preach a sermon? Must it not be perfectly clear to every one that the *x*-ray should not be used by untrained hands, and that it is a very powerful agent that may do much good or may do much harm? Burns may occur even in the hands of the greatest expert. When we refer a patient to an *x*-ray laboratory for *x*-ray treatment we should feel confident that the *x*-ray treatment will be given by some one who realizes the dangers, and who is sufficiently well-trained to reduce the chances of burning the patient to a minimum and to a very small fraction. I think this is the first lesson taught in this sermon, and the second is that to cure these patients we should very early resort to the removal of the damaged tissue and to skin-grafting, both for the purpose of curing the patient of his immediate disability and of making as remote as possible the development of a resulting epithelioma.

TWO CASES OPERATED ON UNDER LOCAL ANESTHESIA —ONE AN ACUTE APPENDICITIS AND THE OTHER A CARCINOMA OF THE PYLORIC END OF THE STOMACH

Summary: Case I.—Acute appendicitis in a man of eighty, suffering from a sarcoma of the sternum. Advantage of local anesthesia in a case of this kind.

Case II.—Carcinoma of the pyloric end of the stomach in a man of seventy-eight. Anterior gastro-enterostomy—technic employed. After-history.

I DESIRE to present to you this morning 2 cases of unusual interest. The patients are both old men, one eighty and one seventy-eight, requiring surgical treatment, and they are both so handicapped because of their age and organic disease that a general anesthetic, either ether or gas and oxygen, seems distinctly contraindicated, and on that account I shall attempt to do both of these operations under local anesthesia.

The first patient is a man of eighty who has been in the Presbyterian Hospital under the care of Dr. B. W. Sippy and my associate, Dr. D. B. Phemister. He has been here for several weeks suffering from what is apparently a sarcoma beginning in the upper end of the sternum, especially the left side of the sternum. A section of the tissue has not been obtained, but the physical examination and careful x-ray examination of the chest seem to exclude a diagnosis of aneurysm or of any other lesion except that of primary sarcoma of the sternum. The patient has a very bad heart. Outside of the heart trouble and sarcoma of the sternum his general condition is good for a man of his age. Last night he was suddenly seized with a very acute pain in the abdomen. This was at first general, but finally has localized about the appendix. He has become quite distended and the abdominal muscles are very tense, distinctly more marked upon the right side than upon the left. The urine is normal. The leukocyte count is 16,000. His pulse and temperature are practically normal.

Dr. Sippy and I studied the case with a good deal of care, and because of the findings and by excluding other possible lesions that might give a similar picture we have arrived at a clinical diagnosis of appendicitis. The case is so acute and the abdomen is so tense, with beginning tympany, that we do not feel warranted in allowing him to go on without the benefit of an exploratory operation. Because of his heart condition I agreed to do the operation under local anesthesia. I have explained this to the patient, and he is quite willing to have the operation and have it done under a local anesthetic.

The patient has been prepared and, as you will notice, the abdomen is very much distended, very rigid, and exquisitely tender over the right lower quadrant (Fig. 392). I begin by infiltrating the line of the usual appendix incision with a solution of $\frac{1}{2}$ of 1 per cent. novocain with 1 : 100,000 adrenalin. I use, as you see, a very fine needle for the first injection, and then infiltrate the skin for a distance of about 6 or 7 inches in length, then the superficial fascia, and then, introducing the needle a little deeper, I feel that I have passed it into the layers of the abdominal muscle. One cannot distinguish distinctly between the needle passing through the internal oblique and transversalis, but one can feel quite distinctly that the needle does pass into the external oblique. I now make a long incision, about 6 inches in length, through the skin and superficial fascia, and then infiltrate the external oblique with two or three syringefuls of the solution. I now divide the external oblique and retract the edges of the incision widely, expose the internal oblique, and infiltrate this in the same way. This part of the operation is quite painless. You will notice that I have used the novocain solution very freely and have already used about 3 ounces of it. Taking two dissecting forceps without teeth and with blunt dissection, I separate the line of the fibers of the internal oblique and transversalis and expose the peritoneum. I retract the internal oblique and transversalis and the edges of the external oblique with four retractors, two in the hands of each assistant, exposing the peritoneum for an area of about $2\frac{1}{2}$ inches in diameter. I then very carefully infiltrate the peritoneum. I do this because the parietal peritoneum is very sensitive. I then divide the peritoneum, making an opening about 2½ inches in length. The ascending colon at once comes into view, and I draw this out gently with two pairs of dissecting forceps without teeth, and with a syringeful of novocain solution I infiltrate the mesentery at the ileocecal junction. In spite of the fact that I have drawn the bowel out very gently, this has given the patient some pain, especially when I make an effort

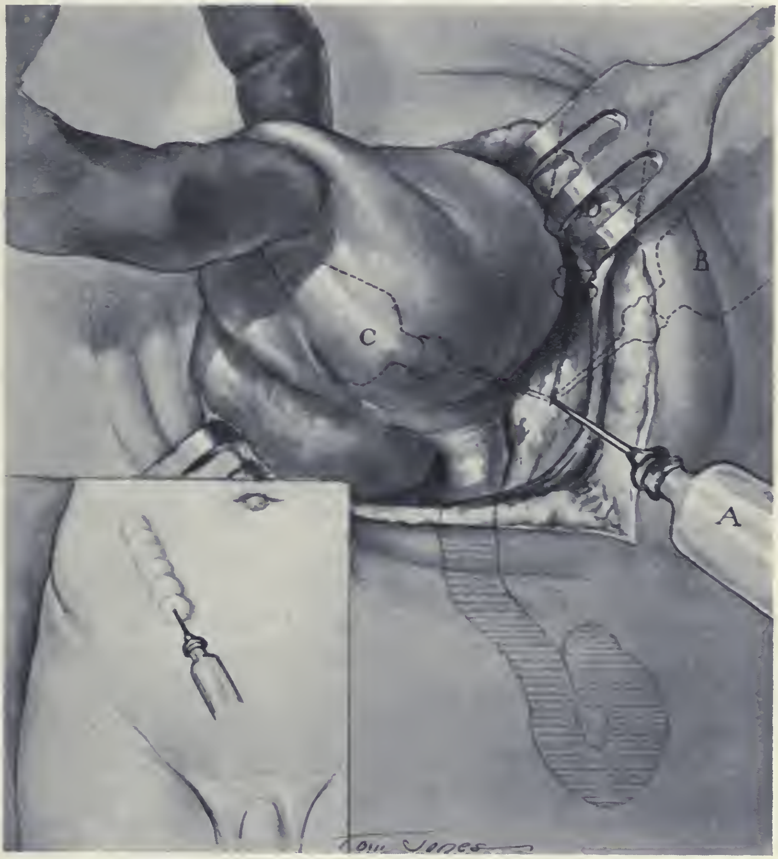

Fig. 392.—Acute appendicitis. Insert shows method of infiltration. Note injection of mesentery of appendix (*A*, *B*, *C*, *D*) before removal from abdomen. Appendix shown by shaded area.

to draw the appendix into view. Following down the ascending colon toward the cecum, I now pull the cecum into view, but find that I cannot bring the appendix out of the abdomen on account of adhesions. I use another syringeful of the novocain solution and inject the mesentery about the appendix. With artery forceps on the appendix, first at its base and then applying the forceps about $\frac{1}{2}$ inch further down and then another $\frac{1}{2}$ inch until I reach the end, I finally draw the appendix out of the abdomen. At the same time I do this I very gently separate with my gloved finger the adhesions which surround it. I now have the appendix entirely free, and you see it is curled up on itself. It is about $3\frac{1}{2}$ inches long. The last inch is curled up on itself and is gangrenous. Fortunately, it has not perforated and there is no free pus in the peritoneal cavity. The patient had, as you could see, during the few moments that I was bringing the appendix out from its surrounding adhesions considerable pain, but now that the appendix is free the pain has disappeared entirely and we can without any distress whatever complete the operation.

I first ligate the mesenteriolum with catgut and then crush the appendix with heavy forceps about $\frac{2}{3}$ inch from the cecum, ligate it at its crushed point with black silk suture, and cut off the portion of it beyond the ligature. I touch the stump with half a drop of carbolic acid, which is then carefully wiped off, and invaginate the appendix with first a linen purse-string suture and over this a suture of fine catgut. I then close the abdominal wound of the muscle-splitting incision with very fine catgut for the peritoneum, silkworm-gut for the internal oblique and transversalis and external oblique, using two silkworm-gut sutures through the skin, superficial fascia, and external oblique so as to obliterate the dead space in this abdominal wall, which would be quite large because of the depth of his superficial fat, which is, as you see, about $1\frac{1}{2}$ inches in thickness. I leave in a small split rubber tube, which, however, I expect to remove within forty-eight hours.

I am glad of the opportunity of showing you this case because it demonstrates, first, the use of local anesthesia in cases of this kind. If it were not for his heart condition I should have given him a few whiffs of nitrous oxid gas for the few moments of the operation in which I was separating the appendix from its adhesions and bringing it out of the abdominal incision. You might say to yourselves that a demonstration of this kind shows that an appendectomy in a very acute case can be successfully done under local anesthesia; and that, of course, is true, but it certainly is not the best method to adopt in the usual case. I have no hesitancy in strongly recommending as the anesthetic of choice ether in the ordinary appendix operation. I have in my own experience had one series of over 1000 consecutive cases of removal of the appendix between attacks in which ether was used as the anesthetic without having a single death. Such a series is, to my mind, a very strong argument in favor of ether as being certainly a safe anesthetic. It is also very efficient. You secure complete relaxation and, what is very important, you place your patient in a condition in which he is entirely unconscious of the operative procedure. Taken as a whole, I would recommend, as I have said, ether as the anesthetic of choice in appendectomy, particularly in acute cases. One might employ gas and oxygen as we have done in many appendectomies. It is, however, not as satisfactory as ether as a routine. It does not obtain as complete relaxation and, on the whole, is certainly not as safe as ether. I believe, however, that all three methods have a place and that each one has a perfectly legitimate field of usefulness in abdominal work, and in the case that we have just operated on, weighing all the evidence, I would advise as we did in this case the use of a local anesthetic.

The dressing is now applied and the patient is quite comfortable.

After-history.—The following morning the patient was able to sit up in bed, read his paper, take liquid nourishment, and was very comfortable. He did unusually well for a week following the operation. He was very cheerful and very happy over his recovery in spite of the fact that he still had the heart lesion and the sarcoma of the sternum. During the night after the nurse had left for a few moments he died, evidently very suddenly, from a heart attack. It was impossible to obtain a postmortem examination of the case, but there is little doubt of its being a sudden heart death due to his old heart trouble, though one cannot exclude the possibility of pulmonary embolism in the absence of a postmortem examination.

Case II.—Our second patient is a man of seventy-eight, a veteran of the Civil War, who was referred to me by an old colleague of mine, with whom I studied medicine in Vienna thirty years ago, Dr. L. C. Taylor, of Springfield, Illinois. This old veteran is a good soldier. He has been telling my assistants of the part that he and his company took in the battle of Nashville and how they captured eight guns from the enemy. I have explained to him the fact that because of his condition it would be necessary to operate on him under a local anesthetic, and he has agreed to the proposition. Dr. Taylor had him under observation for some time and made a diagnosis of carcinoma at the pyloric end of the stomach with a fairly complete obstruction. He has lost a good deal of weight and is very weak from starvation. The *x*-ray plates show a filling defect at the pyloric end of the stomach. With the obstruction and the absence of free hydrochloric acid there is little doubt as to the diagnosis. What I contemplate doing is an exploratory operation, and we shall decide after we open the abdomen whether to make the operation purely exploratory, or whether to do the palliative operation of gastro-enterostomy or resection.

I infiltrate with the same novocain solution the abdominal wall in the midline from the ensiform to an inch or two below the umbilicus, going to the left side of the umbilicus (Fig. 393). I then divide through the skin and superficial fascia of the linea alba. Coming down to the peritoneum, I now infiltrate this thoroughly with novocain solution. Dividing the peritoneum the full extent of the incision, I now very gently draw the stomach up into view. Pulling on the stomach is a little distressing to the patient, but he does not complain of the procedure. I infiltrate the hepatic omentum and the great omentum extending from the stomach down to the transverse colon and the peritoneum around the duodenum with local anesthetic (Fig. 394). Bringing the stomach, which is fairly movable, out of the abdominal cavity, you see that he has at the pyloric end of the stomach a carcinoma about as big as an egg, although, of course, irregular in outline. The glands are not extensively involved. There is, however, one good-sized gland which is palpable over the greater curvature of the stomach and just to the left of the pylorus. There is no evidence of any other glandular involvement or of any metastatic masses either in the liver or elsewhere in the abdominal

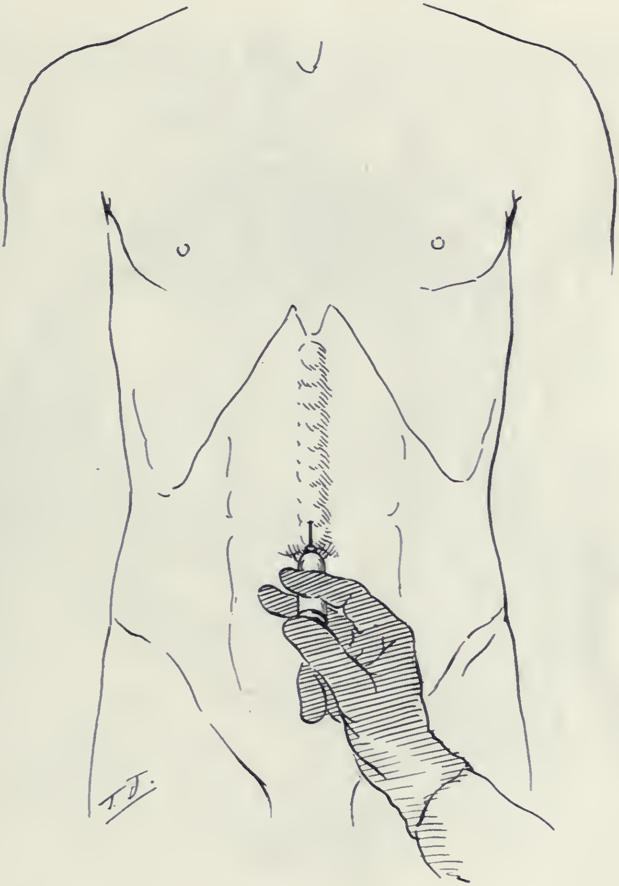

Fig. 393.—Subcutaneous injection of line of incision, which extended from ensiform to umbilicus.

cavity. On that account I intend to resect the stomach, and shall do a typical Billroth second operation (Fig. 395).

Beginning near the greater curvature with a series of ligatures, I ligate the vessels between the stomach and the transverse colon. This opens, of course, the lesser peritoneal cavity. I then ligate off the gastrohepatic omentum in the same way, mobilizing completely the carcinoma. I then very carefully free the first 2 inches of the duodenum. I now crush the duodenum

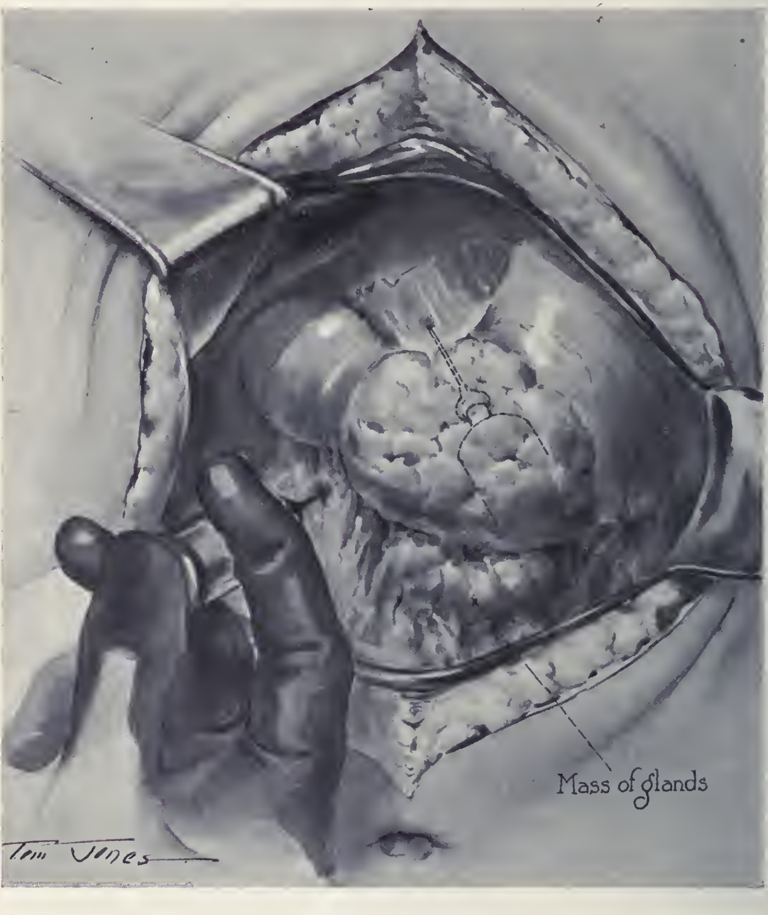

Fig. 394.—Infiltration of gastrohepatic and gastrocolic omentum before freeing tumor. Note mass of glands along greater curvature.

just distal to the pylorus with a very heavy crushing forceps and ligate it off with heavy silk ligature. I now take the electric cautery and cut off the duodenum just proximal to the ligature after clamping the pyloric end of the stomach so as to prevent the escape of any stomach contents. The handling of the duodenum is the most important part of a stomach resection. It is very important to make the duodenal closure so as to prevent any leakage. I now put a purse-string suture about $\frac{2}{3}$ inch from my silk ligature on the duodenum and invaginate the stump carefully. I then tie the purse-string suture. This purse-string suture is of linen. I now put a second purse-string suture, also of linen, over the first. The second one, however, is placed about $\frac{1}{4}$ inch further down on the duodenum. I now put on a stom-

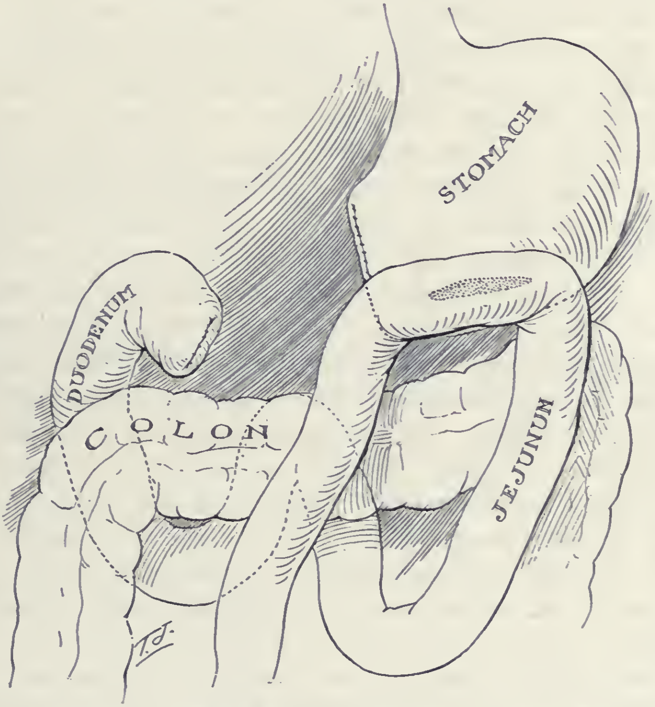

Fig. 395.—Diagram showing Billroth II method of closure with anterior gastro-enterostomy.

ach clamp protected with rubber tubing to the left of the carcinoma on the stomach, and again with the electric cautery I divide the stomach about ½ inch from the clamp, after having, as you see, put on another stomach clamp so as to prevent the escape of any of the stomach contents. I shall now close the end of the stomach with three rows of sutures; the first one is simply through the mucosa, the second through the peritoneum and muscularis, and the third is a typical Lembert. We have now removed the carcinoma and have closed the duodenum and the end of the stomach. Our next problem is to unite the jejunum to the stomach. We could do this either as a posterior gastro-enterostomy or as an anterior gastro-enterostomy. I think, on the whole, the anterior gastro-enterostomy in this case is to be preferred. I shall then take a loop of the jejunum about 15 inches from its beginning and bring this in front of the transverse colon, and make an anastomosis between this loop and the anterior surface of the stomach. My own impression is, there is very little difference in the result whether we make an anterior or posterior gastro-enterostomy in these stomach resections. As I understand, Balfour, in the Mayo Clinic, has rather favored in their recent cases the anterior position of the gastro-enterostomy. My own assistant, Dr. Gatewood, feels rather strongly that the posterior operation is the operation of choice, and thinks that the cases in which we have done the posterior operation have done better than those in which we have done the anterior.

The patient, as you see, has stood the operation very well indeed and (as you heard him) in a fairly loud voice he is able to thank us for what we have done for him.

After-history.—The patient made a very good operative recovery as far as the wound was concerned, but he had a rather hard time of it for a number of days because of what seemed like a partial gastric ileus or, expressed in another way, a moderately acute dilatation of the stomach. This, however, was controlled by washing out twice a day, morning and evening. In spite of this he vomited for a number of days. This evidently was not due to any mechanical obstruction due to failure of our surgical technic, but I think quite definitely due to a paralyzed condition of the stomach. He had had the obstruction so long that the stomach was like an old paralyzed bladder which has been distended for a long time because of prostatic hypertrophy, and it takes a long time to regain its muscular power. At the end of about two weeks he began to pick up rapidly. The stomach regained its power of expulsion and he began to eat semisolid food and went on and made a very satisfactory and complete recovery.

This case again demonstrates the possibilities of local anesthesia in very extensive abdominal operations such as resection of the stomach. I have resected more than half of the large intestine under local anesthesia. We did that in a case in which the patient had a carcinoma of the bowel and also a carcinoma of the larynx. The carcinoma of the bowel was the imperative condition demanding relief because of marked obstruction. Because of the carcinoma of the larynx we felt compelled to do the operation under local. Here again I want to say that where the condition of the patient warrants I much prefer to do a stomach resection under ether than under local or under nitrous oxid and oxygen, but there are certain cases in which because of the age and weakness of the patient and the starved condition, very often the acidosis of starvation being present, there is no choice. One cannot operate on some of these cases safely with ether, and one is compelled to do the operation under local anesthesia, as we have done this morning. I feel that more and more in the future we shall extend the field of local anesthesia in abdominal work and, for that matter, in almost all the surgical fields. I do not, however, regard local anesthesia as ideal. I do not feel that it will ever displace general anesthetics, which have the virtue of rendering the patient unconscious and oblivious to what is being done during a serious surgical operation. There is a definite place too for the mixed procedure in which the abdominal incision is made under local, in which some of the painful steps of the procedure are made under nitrous oxid and oxygen, and in which the operation is then completed under local anesthesia. The position, however, to my mind, remains unchanged, and ether remains the anesthetic of choice. In those cases, such as the 1000 appendectomies which I have just referred to in my own series in which ether was used without a single death, where there is no special reason for employing a local anesthetic or gas and oxygen or where there is no definite contraindication to a general anesthetic, I would employ ether.

TWO CASES OF MEDIASTINAL TUMOR WHICH PROVED TO BE SUBSTERNAL THYROID ENLARGEMENTS

Summary: Two patients presenting the clinical signs and symptoms of mediastinal tumor. History and physical findings. Operation—both cases proved to be substernal thyroid enlargements. After-history.

I HAVE within the last year had two very unusual cases on my service, cases in which the clinical diagnosis was that of mediastinal tumor and in which operation proved that the tumors were substernal thyroid enlargements. These cases have been so instructive to me both from the standpoint of diagnosis and surgical therapy that I have thought it worth while to report them.

Case I.—A man of fifty-five was referred to me from a neighboring state by his brother, who was a medical colleague of mine. The patient had noticed for some months increasing difficulty in breathing, especially upon exertion. A little later his voice became husky and at times would be almost lost. He then noticed great distention of the veins of the upper part of the chest and the neck. The veins became hugely distended, especially on exertion, and the chest and neck became enormously swollen. His face became cyanotic. It was quite evident that he had pressure upon the great veins in the mediastinum and on the recurrent laryngeal nerve, and probably also upon the trachea and bronchi.

On physical examination by percussion the upper part of the chest was dull for an area larger than my fist in the midline beginning with the tip of the sternum. In the greatly swollen neck on the right side could be palpated by deep palpation a moderately enlarged right thyroid lobe. The *x*-ray showed a tumor in the mediastinum larger than my fist. There was no history of a specific lesion, the Wassermann reaction was negative, and there were no physical findings of aneurysm. The aneurysm was ruled out as a probability, but not entirely as a possibility, in the case. The clinical diagnosis was that the tumor in the mediastinum was an enormous substernal thyroid enlargement, probably with an enlarged right lobe of the thyroid which could be palpated.

The symptoms of pressure had grown steadily worse week by week, and operation for relief was evidently absolutely indicated even though it carried with it considerable risk. I made up my mind to attempt to see what could be done under local anesthesia from above, and that if it could not be removed by opening the mediastinum through the neck incision, I would either at that time or later divide the upper half of the sternum by a vertical incision and saw through the sternum about 3 inches below its upper end, separate the two halves of the sternum with some powerful separator like we are using in work on the chest for separating the ribs, and attempt to obtain an exposure that would enable me to remove the mass if it were possible to accomplish this. I felt that if the mediastinal mass was benign in order to save the patient's life it would be necessary to remove it. The patient was a very level-headed, intelligent man whom I knew would co-operate with me in every possible way in the undertaking.

Under local anesthesia I made an incision along the inner border of the sternocleidomastoid from the angle of the jaw down to the sternum. I divided the sternal insertion of the sternocleidomastoid, divided the deep cervical fascia, and exposed the anterior belly of the omohyoid, and divided this so as to gain a wider exposure. This enabled me to bring into view the moderately enlarged right lobe of the thyroid gland. Retracting the edges of the incision so as to open it widely, I introduced the index-finger of the right hand into the mediastinum following the surface of the thyroid gland. Without any difficulty I could at once convince myself of the fact that the moderately enlarged thyroid gland which we palpated in the neck extended into the huge tumor in the mediastinum which we could see in the *x*-ray picture. With the gloved finger I attempted to find a line of cleavage between the tumor and the other structures in the mediastinum. I could do this for a distance of about 3 inches below the sternum, but I could not bring the mass out of the chest as one ordinarily can even in a good-sized substernal goiter. I then thought of another procedure that might enable me to bring the tumor out of the chest cavity. I ligated separately the thyroid vessels and very carefully sepa-

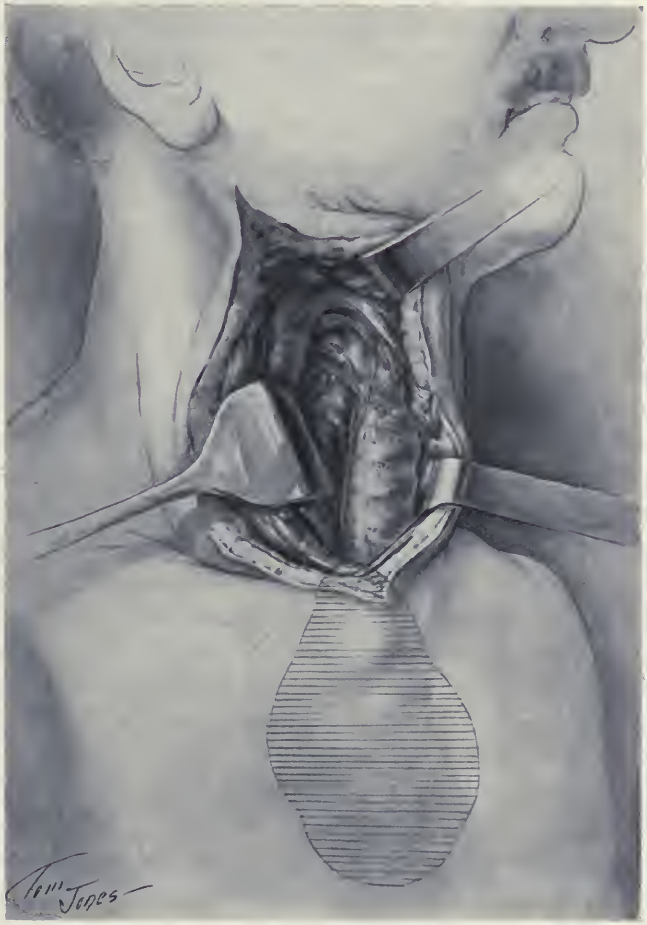

Fig. 396.—Mediastinal thyroid. Note incision parallel to sternocleido-mastoid muscle. The omohyoid has been divided. The recurrent laryngeal is clearly seen. No evidence of the thyroid gland (shaded area) visible except when patient swallowed.

rated the thyroid lobe in the neck from the surrounding structures, isolated the isthmus of the thyroid, and divided it so that I could free the entire right lobe, at least that part of it that was in the neck, from the surrounding tissues, ligating at the same time the inferior thyroid vessels and hugging the posterior surface of the thyroid closely so as to avoid injury to the recurrent laryngeal nerve. When I completed this I could use that portion of the thyroid gland in the neck as a handle, and I grasped it in some large sponge forceps and attempted by making upward traction with one hand and making a blunt dissection with my gloved finger around the tumor in the mediastinum, to dislocate the mediastinal tumor and bring it into view. I found, however, that I was unable to do this. I felt at this time if I had had a very small hand I could have introduced it into the mediastinum through the small circle that was formed at the upper part of the chest by the first rib and the sternum, and that I would have been able to have freed the tumor by blunt dissection from the surrounding tissues and brought it out of the chest. I recognized the fact, too, that if I had split the upper half of the sternum and increased to a sufficient extent the diameter of the upper opening of the thorax, I would have been able to have removed the tumor. Because of my tugging at this time the patient was uncomfortable, and although he co-operated with me in every way, I felt that it was not wise to divide the sternum, and I thought of another possible procedure, that of removing the mass by morcellement.

Using several sponge forceps, I grasped the upper end of the tumor, pulled it upward and outward, and then grasped the mass a little lower with a second pair of forceps. I then removed the thyroid tissue piecemeal, somewhat in the same way as we have done, following the example of the French surgeons removing fibroid tumor of the uterus by morcellement through the vaginal route, and in this way we succeeded in removing a very considerable part of the substernal thyroid mass, but I was certain that I had not by any means removed all of it. Finally, I had considerable hemorrhage which required packing to control, and I determined to desist from any further operative procedure at that time. I therefore packed in some iodoform gauze which very readily controlled the bleeding, closed the upper part of the incision, but left the lower part open for the iodoform gauze.

Fortunately, the patient made a very excellent operative recovery. The removal of a considerable mass of thyroid tissue from the mediastinum relieved him very greatly of the pressure symptoms. The venous engorgement within a few days was distinctly less and breathing was freer and less arduous, and within a short time the evidence of pressure on the recurrent laryngeal nerve was distinctly diminished. He remained under my observation at the hospital for several weeks, and left the hospital with a suppurating sinus which I thought would probably close within a short time, so I allowed him to return to his home in Ohio to report to his attending physician. The attending physician kept me posted as to the future outcome of the case, which was interesting and very satisfactory. After a rather long period of profuse suppuration he finally passed a sloughing mass, probably a considerable part of the thyroid, and the fistula then closed, and he was practically entirely relieved of his pressure symptoms. During this period I did two things which I thought might have some value in diminishing the amount of thyroid tissue which I had left in the chest. There had been no toxic symptoms, so I did not hesitate to put him on moderate doses of thyroid extract. We also gave him some *x*-ray exposures, with the thought that these might prove of benefit. The final outcome was very satisfactory to the patient in the sense that he is cured of the condition, and *x*-ray examination shows the entire disappearance of the substernal mass.

Case II.—This case is one which I have recently had under observation and one which had been studied by several of my colleagues, Dr. Sippy, Dr. Herrick, and Dr. Abbott, at the Presbyterian Hospital.

The patient was a man about fifty years of age who had within seven or eight weeks developed very marked pressure symptoms in the mediastinum, loss of the voice, pressure upon the veins and upon the trachea and bronchi, and great difficulty in breathing, and marked dilatation of the superficial veins of the upper part of the chest and neck. My colleagues had studied very carefully the physical findings and found an area of dulness in the upper half of the mediastinum. They found that the esophagus was normal. There was no definite evidence of aneurysm, no history of a specific lesion, and the Wassermann was negative. The most interesting bit of evidence they succeeded in obtaining was that in making a fluoroscopic examination of the chest they could see a tumor about as large as a good-sized Bartlett pear, which moved up and down in the chest with swallowing. The tumor was apparently somewhat to the right of the midline. Careful examination of the neck revealed no palpable thyroid gland, and, as a matter of fact, one could not palpate any thyroid gland tissue at all.

My medical colleagues had discussed a number of possibilities—mediastinal tumor, substernal thyroid, and the vague possibility of aneurysm—which, however, they pretty definitely excluded. When they called me into consultation and presented the evidence which they had obtained, I suggested an exploratory operation, exposing the mediastinum from above under local anesthesia. The recommendation was submitted to the patient, who was eager to have an effort made to relieve him of the increasing obstructive symptoms. Without any preliminary morphin I made an incision along the anterior border of the sternocleidomastoid (Fig. 397), as in the previous case, and after dividing the omohyoid and the deep cervical fascia I could freely expose the thyroid cartilage and the trachea, and in the ordinary position of the right lobe of the thyroid gland there was no thyroid gland at all. I then continued my dissection until I could expose the upper part of the mediastinum, following the trachea and esophagus downward. I then retracted the edges of the incision widely and then asked the patient to swallow, and as he did this, coming up from the mediastinum was what appeared like a large lymphatic gland, about as big as the end of my finger. This would come up as he attempted to swallow, and then, as he finished the effort of deglutition, it would pass back out of sight into the chest. I asked him to do this again, and as the small projecting mass came upward I grasped it in a pair of forceps, and on making gentle traction I

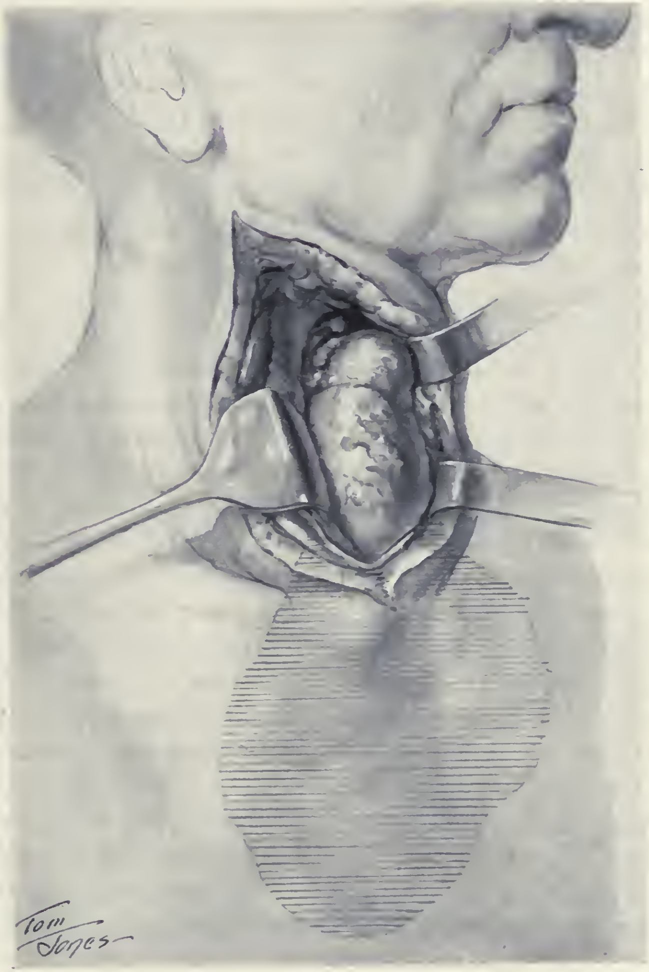

Fig. 397.—Note incision parallel to anterior border of sternocleidomastoid muscle before mediastinal portion of thyroid (shaded area) has been dislocated. Upper portion of gland seen in its normal position.

found that I could pull into view and entirely out of the chest the mediastinal thyroid mass about 4 inches in length and about 2 inches in diameter. The mass was shaped somewhat like a pear, the upper pole being much smaller than the lower pole. By careful blunt dissection with my gloved finger and with a gauze sponge I could free the surrounding areolar tissue and dislocate the mass entirely out of the chest cavity into the neck. I then ligated the superior thyroid vessels which were 4 or 5 inches longer than normal. I then ligated the inferior thyroid vessels. As I dislocated the entire mass into the neck incision I found that it extended over the trachea to the left side. I could readily have removed all of it, but I could not help but feel that it was probably all of the thyroid gland tissue that the man possessed. There seemed to be no evidence of any thyroid tissue on the left side except that continuous with the tumor which I had pulled out of the mediastinum. I therefore left a small portion of the left side of the tumor, clamping it off from the main tumor, and sewed up the raw surface with catgut sutures to control hemorrhages.

The patient stood the operation very well indeed and coöperated with me in every possible way. Fortunately, the wound healed promptly. I made no drainage of any kind. The pressure symptoms have been relieved. The patient is still somewhat hoarse, evidently from the tugging on the recurrent laryngeal nerve or else from the long-standing pressure of the tumor itself from which the nerve has not yet recovered. At the present time, some weeks after operation, the patient seems to be on the road to complete recovery.

We have, of course, had a great many cases of substernal thyroid which were comparatively easily removed at the time of the thyroid operation. These 2 cases, however, presented such unusual features and were so instructive that I have felt that they were of general interest and should be reported.

CLINIC OF DR. ALLEN B. KANAVEL

Wesley Memorial Hospital

SPLENECTOMY UNDER LOCAL ANESTHESIA IN A GREATLY DEBILITATED PATIENT

Summary: Patient suffering from Hanot's cirrhosis, with marked anemia, asthenia, loss of weight, reduced coagulation time, and in such condition as to preclude splenectomy under general anesthesia. Operation performed under local anesthesia by Labat's method; recovery.

The patient here presented, No. 90,816, is in so precarious a condition that the possibility of recovery from an operative procedure is very slight. He is greatly debilitated, and has suffered from cirrhosis of the liver and its accompanying pathologic changes for over three years.

I have already discussed with you in previous clinics the indications for and results of splenectomy. At that time I drew your attention to the fact that the pathologic conditions which are most definitely and favorably influenced by splenectomy are hemolytic jaundice, Banti's disease, Gaucher's disease, and certain types of syphilitic and malarial hypertrophy. I also pointed out that removal of the spleen in hypretrophic cirrhosis of the liver is still in a more or less experimental stage, and that we are justified in the procedure only if we choose cases under proper precautions, after careful clinical study and detailed laboratory examinations, directed toward estimating the extent of pathologic change in the various body functions. Under such conditions an increasing series of cases will eventually indicate what results may be hoped for from surgical treatment, and with what type of cases and in what stage of the disease operation may be successfully carried out. I shall not discuss these questions further with you today, but draw your attention to the technic used in the preparation of the patient and in the treatment of this particular case, reserving for a future time the report of the results obtained in this type of disease and this particular patient.

The salient points of the history are that the patient is suffering from pain in the upper abdomen, cough, dyspnea, and edema of the ankles. He has lost 40 pounds in weight and has had repeated hemorrhages from the gastro-intestinal tract, blood appearing both in the vomitus and in the stools. These symptoms date back to 1917.

On examination he presents the characteristic findings of hypertrophic cirrhosis of the liver, with moderate emaciation, enlargement of the liver and spleen, ascites, and deep jaundice.

His red cell count is 3,400,000; his leukocyte count is 11,800. The coagulation time of the blood is six and a half minutes, and the clot is very soft. The fragility test shows hemolysis beginning at 0.38 per cent., and complete at 0.24 per cent. The urine shows a few casts and a trace of bile. Stercobilin is present in the feces, but there is no bile. Repeated examinations of the stools show no ova or parasites. The Wassermann examination is negative.

I wish to emphasize the great debility of this patient, the low coagulation time, the marked anemia, and the impairment of function in the kidney and liver. When we remember that the liver is especially active in the excretion of poisons, the danger of anesthetizing this patient with ether or chloroform is at once apparent. Because of his weakened heart muscle the administration of nitrous oxid would be attempted only in case of necessity. With his marked anemia it is evident that he cannot stand the loss of any considerable amount of blood without jeopardizing his life, and because of the low coagulation time any operative procedure is attended by considerable risk, even by the possibility of a failure of the blood to coagulate. This is of particular importance when we remember that dilatation of the veins and thinning of the vessel walls are invariably present in cases of splenic enlargement, and that the danger of sudden and profuse hemorrhage is increased by the inaccessibility of the bleeding vessels. We have, therefore, prepared for a transfusion of blood to be carried out during the operation. We have found on examination that the patient belongs to Group I, according to Moss's classification, and we have secured a donor from Group IV. In other words, we will give the blood of a member of the "universal donor" group to a member of the "universal recipient" group. The patient has had large amounts of fluid during the past twenty-four hours in the hope that the function of his kidneys will be stimulated. He has been given as much food as possible, so that in spite of the fact that it has been necessary to give it in fluid or semifluid form, because of the hemorrhages that have followed the administration of solid food, he has for some time received the equivalent of 3500 calories daily.

Before coming to the operating room he was given a preliminary injection of scopolamin, $\frac{1}{120}$ gr., and morphin, $\frac{1}{6}$ gr., not sufficient, of course, to produce complete anesthesia, but sufficient to lessen his response to his surroundings. We shall use for local anesthesia $\frac{1}{2}$ per cent. novocain with 5 drops of 1 : 1000 adrenalin chlorid solution per ounce. We will first anesthetize the anterior abdominal wall. This can be done by a variety of methods, and should be entirely painless throughout the injection. My own procedure is first to inject the superficial layer of the skin at the points at which we expect to introduce the solution. The points chosen for injection are, first, immediately below the xiphoid cartilage; second, at the junction of the tenth rib with the abdominal wall; and third, about 1 inch above the umbilicus at the outer edge of the rectus on either side. Through the wheals previously made with a fine needle a fairly large needle, 4 inches in length, is passed through the skin with a boring motion so that the surrounding subcutaneous tissues may be injected. The needle is also passed into the rectus muscle, and from $\frac{1}{2}$ to 1 ounce injected into its substance; ordinarily the former amount is sufficient. In this case I am having some difficulty making sure that my needle lies in the rectus and not in the peritoneal cavity because of the extreme thinness of the abdominal wall, the distention of the abdomen incident to the enlargement of the liver and spleen, and the considerable amount of fluid that is present in the peritoneal cavity. By forcing fluid ahead of the needle, however, as we pass through the space between the internal and external oblique, we are able to distend the tissues and inject between the muscles and into the rectus with safety.

We now turn the patient on his side, putting a small pad under the lower ribs, so as to keep the spinal column straight and parallel with the table. This method of injection has been described by Labat, who has practised it with considerable success. As you know, laparotomy under local anesthesia is difficult, not because we cannot secure a complete anesthesia of the anterior abdominal wall, nor because of the sensitiveness of the viscera themselves, but because pulling upon any of the viscera causes irritation of the celiac and other sympathetic plexuses, and is followed by intense pain. Labat's method has apparently been successful in preventing excessive pain from this source in a large percentage of cases.

It is our purpose, if possible, to pass a needle obliquely inward, so as to penetrate the retroperitoneal tissues in front of the first lumbar vertebra, and to inject about the abdominal sympathetic trunk a considerable amount of novocain solution. We locate the twelfth rib and twelfth dorsal spine, and immediately below it the first lumbar spine. We mark the spinous process of the first lumbar vertebra, and from this point draw a line in a lateral direction exactly perpendicular to the axis of the spinal column. This should intersect the twelfth rib, approximately 7 cm. from the spinous process. The body of the first lumbar vertebra is also approximately 7 cm. directly anterior to the tip of its spinous process, so if at the point of intersection of our lateral line and the twelfth rib we insert a needle 12 cm. in length obliquely forward (ventrally) and inward at an angle of 45 degrees, it should strike the lateral surface of the body of the first lumbar vertebra at a distance somewhat less than 10 cm. In other words, the needle forms the hypotenuse of a right-angled triangle, one of whose sides is a line extending directly lateralward from the spinous process of the first lumbar vertebra, and the other a line extending directly anterior (ventralward) from the same point.

You will notice that this needle is being passed without the syringe attached, so that if we should perforate a blood-vessel we would recognize the fact immediately, and not run the risk of injecting our anesthetic solution directly into the bloodstream.

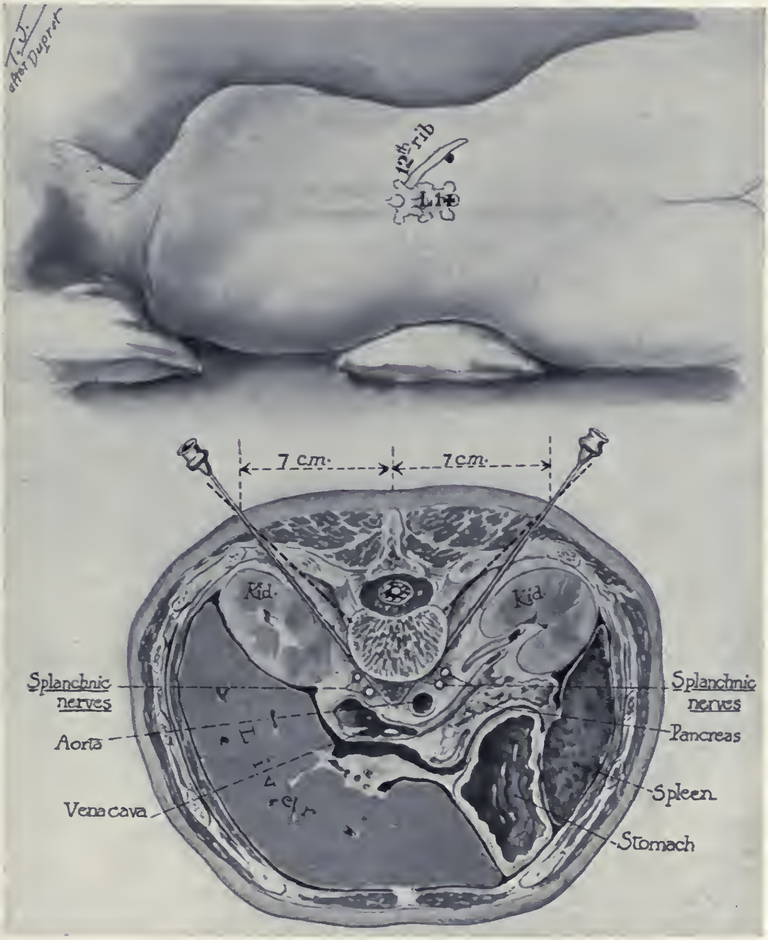

Fig. 398.—Labat's method of local anesthesia (after Labat).

When the point of our needle strikes the lateral surface of the first lumbar vertebra we partially withdraw it, and reinsert it at a slightly less oblique angle, *i. e.*, the point of the needle, instead of being directed toward the median plane of the body, is directed toward a point 2 to 4 cm. lateralward from the median plane, our purpose being to slide the needle over the lateral surface of the first lumbar vertebra and penetrate the retroperitoneal tissues. As we do this I feel the needle pass over the surface of the vertebra into less dense cellular tissue at a depth of 10.5 cm. No blood flows through it, so we may feel certain we have not penetrated a blood-vessel. We inject 35 c.c. of ½ per cent. novocain solution, though Labat uses as much as 35 c.c. of a 1 per cent. solution. We then turn the patient to the opposite side, and infiltrate that side in a similar manner.

It is well to wait for ten or fifteen minutes before beginning the operation to permit the anesthetic solution to attain its full effect. Meanwhile the arm will be prepared for the injection of the blood, and the abdomen for the abdominal incision.

We make the incision in the left rectus from below the umbilicus upward to the ribs and medialward to the ensiform cartilage. We come directly upon a tremendously enlarged liver, with a roughened, mottled surface. To the left and partially covered by the left lobe of the liver is the large, blue spleen. It is evident I will be unable to deliver the spleen through this incision, since the liver is so large and so firmly fixed. I will therefore make a second incision extending lateralward, at right angles to the first, and from about its middle point. The spleen is large, and there are numerous adhesions at its upper pole and on its posterior surface, fortunately not so many as I have met with in other cases, but still sufficient to give us some anxiety. We will anticipate the possibility of hemorrhage from torn veins in these adhesions by having at hand two 5-yard rolls of gauze, prepared so that we can insert them immediately if hemorrhage occurs. I am now bringing the spleen downward and forward as gently as possible, with the idea of dislocating it from the abdomen and exposing its posterior surface and upper pole. The presence of this large tortuous vein passing from the spleen to the stomach is a constant reminder of the need of gentleness. With my fingers I am gradually separating the adhesions about the upper pole. There is some little oozing in this vicinity, which I will control by the insertion of gauze packing. Some firm adhesions on the posterior surface are now exposed and can be cut between forceps. We have now dislocated the spleen from the abdominal cavity, and have controlled its pedicle. We will place two forceps on the pancreatic and stomach side and one on the spleen side, cutting as close to the spleen as possible. The two forceps on the proximal side are so placed as to permit the application of a ligature and to prevent retraction of these large veins, which, you can readily see, would be a very serious accident. The splenic artery is grasped separately, with as little other tissue as possible. The pedicle is now incised between the forceps and the spleen removed. We will have it weighed and a pathologic examination made.

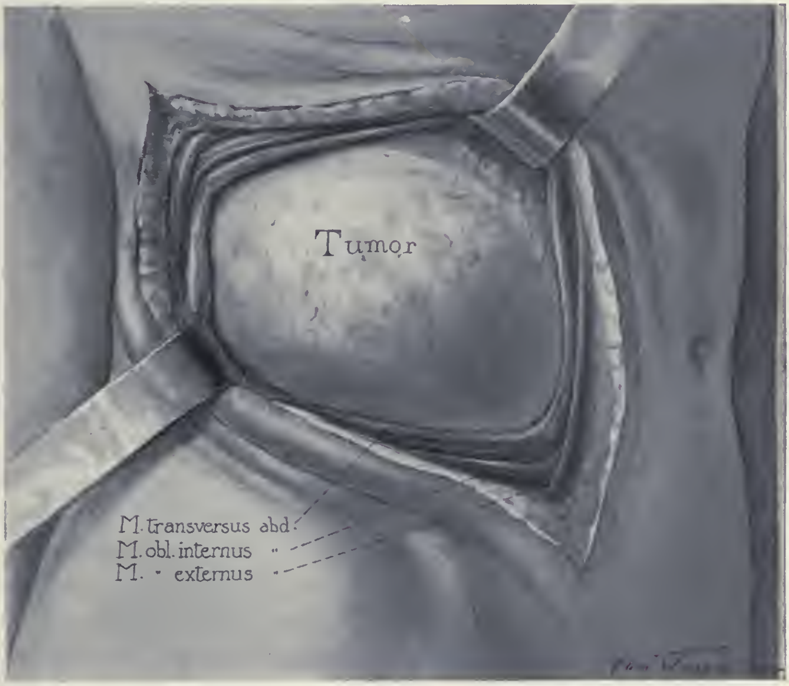

Fig. 399.—Muscle-splitting incision for the removal of retroperitoneal tumors.

We now remove the proximal of the two forceps on the pedicle in each section, and ligate with braided silk. I put on a second ligature as I remove the distal pair of forceps, so that we will have two ligatures on each section of the pedicle. We have taken care, of course, not to include the tail of the pancreas nor a section of the stomach in our ligatures.

Let me draw your attention to the fact that in this entire manipulation there has been considerable tugging and pulling on the abdominal viscera, and yet the patient does not complain in the slightest of pain. His pulse and general condition are practically the same as before the beginning of the procedure. My associate, Dr. Koch, will now begin the transfusion, while we close the abdominal wound, which should be done in layers with catgut and silkworm-gut. I regret the fact that because of oozing that is still present at the point from which the adhesions were torn, it will be necessary to leave a small strand of gauze packed firmly against the bleeding points. This can be brought out at the lower end of our lateral incision.

As to the transfusion you will note that we are using the citrate method, because we wished to have the blood ready for immediate transfusion in case of necessity. I have previously discussed with you the question of the use of citrated blood and non-citrated blood in cases in which transfusion is necessary. Either method is apparently entirely satisfactory. In our earlier group of cases it was not uncommon for us to have considerable reaction following transfusion with blood from members of the same group as the recipient. Attention has been drawn to the fact that this was due to the excessive whipping of the blood during its withdrawal. Since lessening the agitation of the blood during the procedure we have had little or no reaction from citrated blood. We will give this patient 600 or 700 c.c. of blood, keep him well covered, and send him back to his room as soon as the transfusion is completed.

Postoperative Note.—This patient made a complete recovery from the operation and was in excellent condition two weeks after the operation. The spleen weighed 1500 grams.

LAMINECTOMY

Summary: Patient suffering from evidences of compression of the cauda equina; the symptoms have been developing for nine months. Operation discloses the presence of a small enchondroma, lying outside the dura, and adhesions involving the nerve-trunks forming the cauda. At operation the cord was exposed, the extradural tumor removed, and the nerves forming the cauda dissected free from one another. The dura and wound were closed without drainage.

In presenting this patient I wish to draw your attention to the good results that ensue upon operation for pressure on the spinal cord, in contradistinction to the results which are obtained in the ordinary patient suffering with a similar pressure on the brain. Unfortunately, much of the pessimism of the medical profession as regards the cure of patients suffering from brain tumors is justified. While we all can present a fair number of patients who have recovered and have been restored to society as working members, the number who still remain charges upon society or have died within some months after the operation is many more than the number of those who have recovered permanently. In my experience, however, the contrary is true in spinal cord surgery. I now have a considerable number of patients who suffered from spinal cord tumor, who are back at their work, earning their livelihoods, and in many cases completely recovered as far as the functions of their bodies are concerned. The present patient to my mind presents a most favorable outlook, since we find no evidence of destruction of the vertebra, since he is suffering from a lesion in the cauda equina, and since the process has not continued for any considerable length of time.

I shall not attempt to discuss with you the findings in detail, nor the means by which we have arrived at the diagnosis, since our time is limited. In brief, the patient began to complain of severe pain extending down his legs some nine months ago. This was diagnosed by his physician as sciatica. After some weeks the pain disappeared, and the patient continued his work in a logging camp. About three months ago the pain returned with increased severity, and was followed shortly after by a complete retention of urine. An examination by his physician disclosed the presence of anesthetic areas, and a beginning paralysis of some of the muscles of the lower extremity. This has continued until the present time, so that the patient is now unable to walk without crutches, although he has not a complete paralysis of his legs; in other words, while he has had more or less girdle pain across the ilio-inguinal fold, it has not been typical, nor has the paralysis and anesthesia which followed been of the massive type. He has both an irregularity in the distribution of his paralysis and in the distribution of his anesthesia.

Operation upon these patients is generally carried out under general anesthesia, although it can be carried out under local anesthesia. The mortality is extremely low and the results are such as to justify an exploratory incision in case of doubt, though here the symptoms seem to be so definite that we believe we are dealing with a definitely localized process, probably a tumor.

As you will see, the patient is placed upon his face, with sandbags under his shoulders to support his head and make the work of the anesthetist easier. We make a curved incision extending from the left side of the fifth lumbar vertebra across the line of the spine, upward to the eleventh dorsal vertebra, and back to the left side. We retract this flap of skin and subcutaneous tissue to the left, and attach sterile towels to the edges of the skin incision, so as to protect the operative field as completely as possible. The ligamentous tissue between the spines, from the fourth lumbar to the twelfth dorsal spines, is now incised in the median line, since it is my purpose to remove the upper four lumbar vertebræ and proceed upward or downward, as may be indicated after opening the dura. With a needle 4 inches in length we measure the length of the spines and the depth at which the laminæ lie, so that in sawing through the spines we will not penetrate the spinal canal. With a circular saw attached to the motor we now incise the spines from the first to the fourth lumbar, keeping as closely as possible to the median plane. This permits us to approximate the tissues more easily after the operation is concluded, and causes considerably less hemorrhage than the method we previously used of detaching the muscles from the spines and removing the spines *in toto*. Should we inadvertently pass to one side or the other as we go downward it does not make a serious difference, for this method of exposing the cord is not used with the idea of securing greater strength from regeneration of the bone, although this probably ensues. With a chisel we separate the two halves of each spine from the corresponding laminæ at the depth of the incision, and separate the muscles laterally from the laminæ over the extent of our incision. These are retracted to either side so as widely to expose the posterior bony wall of the spinal canal. With a bone-biting forceps inserted underneath the laminæ we remove these piecemeal, until the laminæ of the four vertebræ have been completely removed. You will notice that here and there we have had some difficulty with bleeding as we were

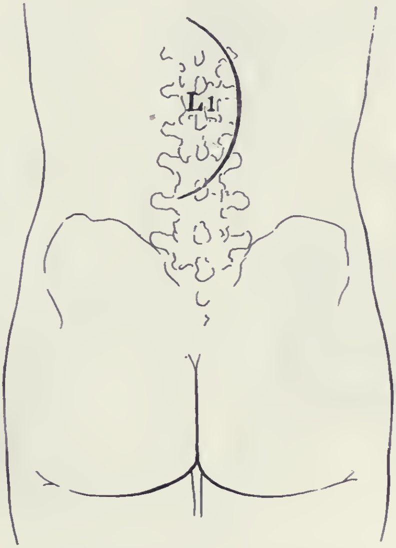

Fig. 400.—Site of skin incision.

detaching the muscles. In these bleeding spaces I have placed small pledgets of cotton to which are attached silk ligatures, so that they will not inadvertently be left in the wound. Where we have oozing from bony surfaces it can be satisfactorily controlled with bone-wax.

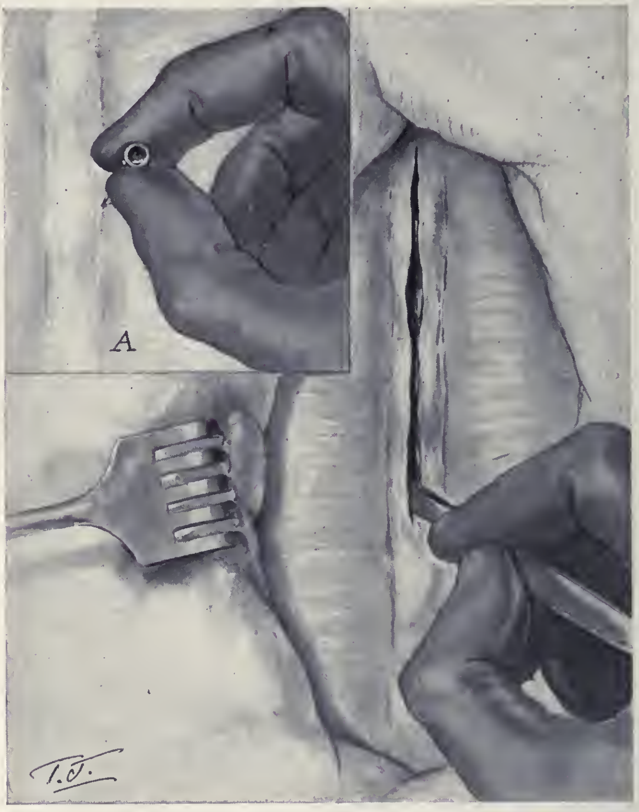

Fig. 401.—Method of determining the distance to the lamina (*A*); incision of the ligaments between the spines.

In my earlier cases I was inclined to make too small an incision, and was sometimes compelled to remove the spine and laminæ of a vertebra above or below after the dura had been opened, a procedure that was at times followed by oozing into the subdural space—a condition which we try to avoid.

We have now removed the cellular tissue outside the dura, and can see here, opposite the third lumbar vertebra, a small cartilaginous body, the size of a bean. It seems to be attached to the surrounding tissues, and yet not grown from them. I am somewhat in doubt as to whether it is a neoplasm, or whether it is a hypertrophy of cartilaginous tissue incident to irritation. We will now open the dura, and you will notice at this point that it is much constricted and whitened. You can see here that the entire group of nerves forming the cauda is bound by fibrous adhesions extending over a distance of ¾ inch; that above this point the nerves are injected and edematous, and below they

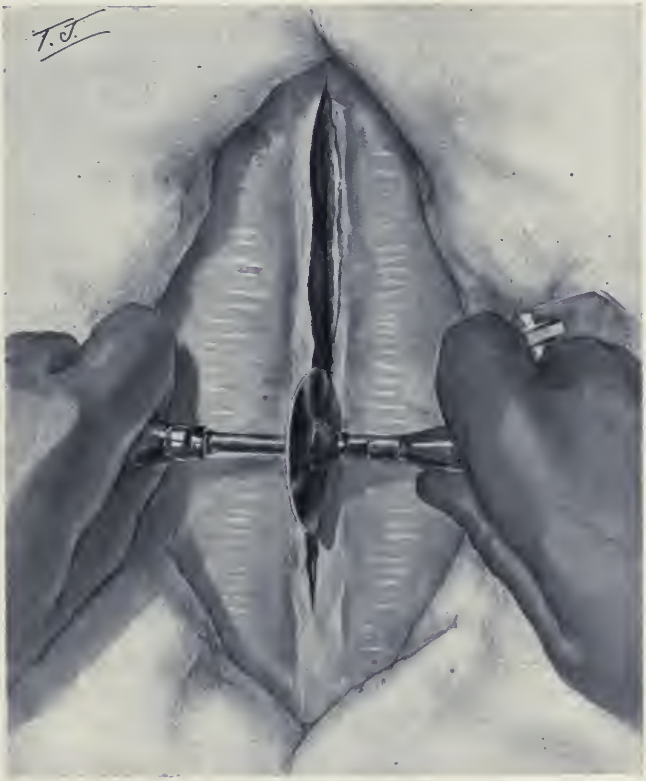

Fig. 402.—Motor saw dividing the spines in the midline.

are quite pale. I use magnifying glasses to permit me to see the details of the nerve structure more clearly than with ordinary vision, and to enable me to dissect out the nerves from the scar tissue which surrounds them, without injuring them in any way.

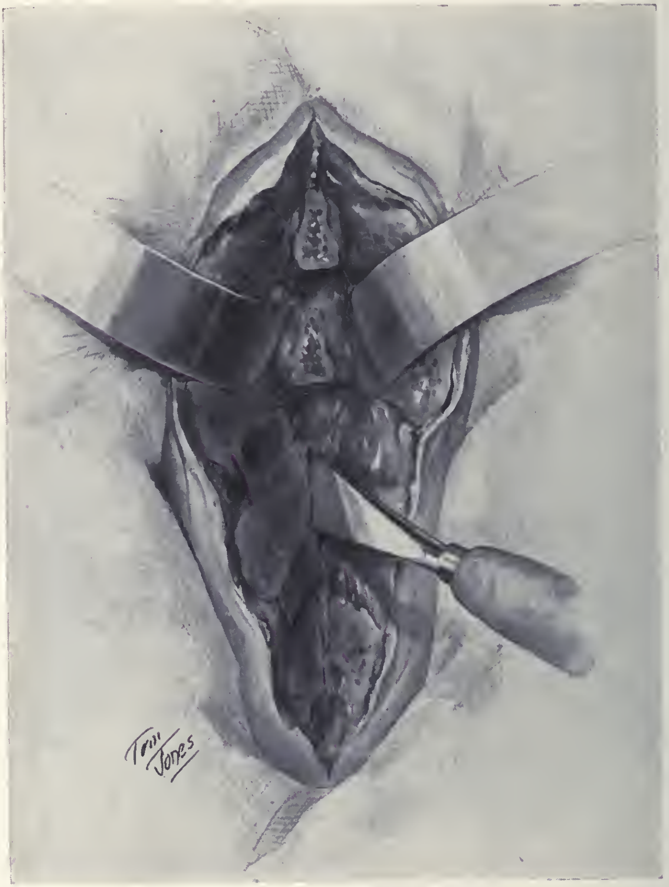

Fig. 403.—Breaking off the split spines at their bases.

Fortunately, I am able to separate them in their entirety. We are very careful to prevent the entrance of blood into the spinal canal, and are extremely careful not to traumatize the nerve tissue, although, of course, this dissection must involve some traumatism. We will remove this small growth outside the dura and close the dura with continuous fine silk. The muscular tissue and the separated spines are sutured in layers with heavy catgut, and the skin is sutured with silkworm-gut.

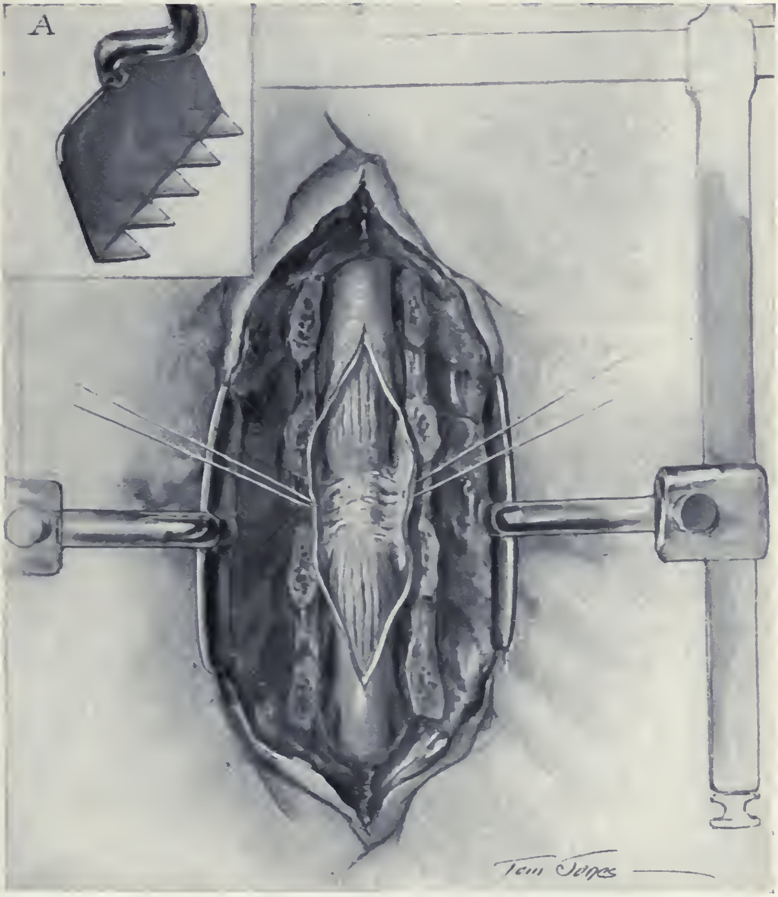

Fig. 404.—Scar tissue binding the nerves to one another and to the dura; the mechanical retractor holding muscles aside.

Postoperative Note.—The patient made a satisfactory recovery from the operation, and at the end of two weeks had regained complete control of his bladder. There was entire restoration of sensory function, except over an area about 2 inches in diameter on his left buttock. Recovery should be complete as regards motor function and the restoration of the patient to society.

I wish to present to you briefly this patient, No. 62,943, operated on at a previous clinic, who suffered from a large tumor mass in the right side in the neighborhood of the kidney. The mass was apparently 6 or 7 inches in diameter, smooth, and not particularly painful. Before operation a diagnosis of tumor of the kidney was made. A lateral transverse incision (Fig. 401), as you can see, was made extending from the right rectus back to the region of the kidney. The mass was large and protruded outward so as to permit us to divide the oblique muscles and transversalis in the line of their fibers. The peritoneum was pushed forward, and underneath it was found a hard, solid tumor not connected with the kidney. The tumor was shelled out from the retroperitoneal tissue without great difficulty, there being no pedicle as far as we could determine. The kidney lay somewhat above it and behind it. The mass was 9 inches in one diameter and 7 in the other. On examination it was found to be a fibrolipoma.

The case is an extremely interesting one, first, from the fact that although the tumor was so large it had not been recognized until six months before; second, from the fact that the patient is sixty years of age; and third, because we were able to remove the tumor without difficulty through a muscle-splitting incision.

This incision I have used a number of times in cases in which it has been necessary to reach a tumor lying at the hepatic or splenic flexure of the colon, and for exposing large tumors of the kidney. If the patient is short and muscular, the incision is sometimes made with difficulty, but ordinarily, if the tumor is of good size and the patient not of excessive muscular development, the incision is made without difficulty, and leaves an excellent line of muscular apposition, with no danger of postoperative hernia and particularly no bleeding from the wound.

CLINIC OF DRS. ALBERT J. OCHSNER AND JOHN NUZUM

Augustana Hospital

LIGATION OF THE INFERIOR THYROID ARTERY AND VEIN ACCORDING TO THE METHOD INTRODUCED BY PROFESSOR DEQUERVAIN. THE USE OF LOCAL ANESTHESIA IN THESE OPERATIONS AND IN THYROIDECTOMY

Summary: Difficulty of ligating inferior thyroid artery. Simplicity, safety, and efficiency of technic introduced by Professor Dequervain. In cases of severe hyperthyroidism only one vessel should be ligated at a time. Advantages of local anesthesia in this procedure and in thyroidectomy in general. Technic of injection. Analysis of 107 thyroidectomies performed under local anesthesia.

The ligation of the superior thyroid artery and vein is so simple that surgeons have naturally fallen into very similar if not identical methods. This is not the case with methods of ligation of the inferior thyroid artery.

The superior parathyroid glands are found usually, one on each side, at the posterior borders of the lateral lobes of the thyroid gland opposite the cricoid cartilage. The inferior parathyroid glands which are supplied by small vessels from the branches of the inferior thyroid artery occupy the cellular interval at the posterior aspect of the inferior thyroid artery and the recurrent laryngeal nerve. It is this close relationship of the recurrent nerve and the inferior parathyroid glands to the posterior aspect of the lateral lobes of the thyroid gland which has induced surgeons in excision of one of the lobes to make the resection intracapsular at the posterior aspect of the gland, the posterior part of the capsule along with a layer of thyroid substance being left behind, attached to the trachea. In this way injury to the recurrent nerve and parathyroid glands is avoided, as the branches of the inferior thyroid artery are ligated after they have pierced the capsule. Dequervain, on the other hand, prefers to ligate the main trunk of the inferior thyroid artery before it pierces the sheath of the thyroid gland just to the inner side of the common carotid artery.

In the ligation of the superior thyroid artery there is no danger of injuring contiguous anatomic structures, neither is there danger of injury because of interference with the circulation of structures outside of the thyroid gland itself.

In this respect also there is a marked difference in the effect of ligation of the inferior thyroid vessels.

In many cases of ligation of the inferior thyroid vessels the parathyroid gland has been injured by direct trauma in case the ligation has been accomplished at the point at which the inferior thyroid artery crosses the recurrent laryngeal nerve at a point directly in front of the inferior parathyroid gland near the outer border of the trachea (Fig. 405).

This point has been chosen by many for the ligation of the inferior thyroid artery because the structures can be located very readily at this location. Again, the inferior parathyroid gland may be destroyed by atrophy or absorption or greatly reduced in its physiologic action in case the inferior artery is ligated at this point because the main vessel supplying blood to the inferior parathyroid gland is a branch of the inferior thyroid artery which is frequently given off at a point very near the location of this ligature, so that the inferior parathyroid gland may be deprived of its entire blood-supply or at least of the greater portion of this. In the former case the harmful effect consisting of tetany in a more or less severe form may be permanent. In case the gland is deprived only of a portion of its blood-supply the effect will be less severe in proportion to the amount of blood-supply that has been lost to the gland. As a rule, compensation will take place through collateral circulation, so that the symptoms of tetany will disappear entirely after treatment, which should consist in the administration of calcium lactate in doses of 10 to 30 grains every two to six hours.

It seems likely that in cases in which tetany follows an operation in which the nutrition of the inferior parathyroid gland has been disturbed without direct injury to the gland itself, the gland acts the part of a transplanted parathyroid, taking up its nutrition from the surrounding tissues and resuming its function after a relatively short time.

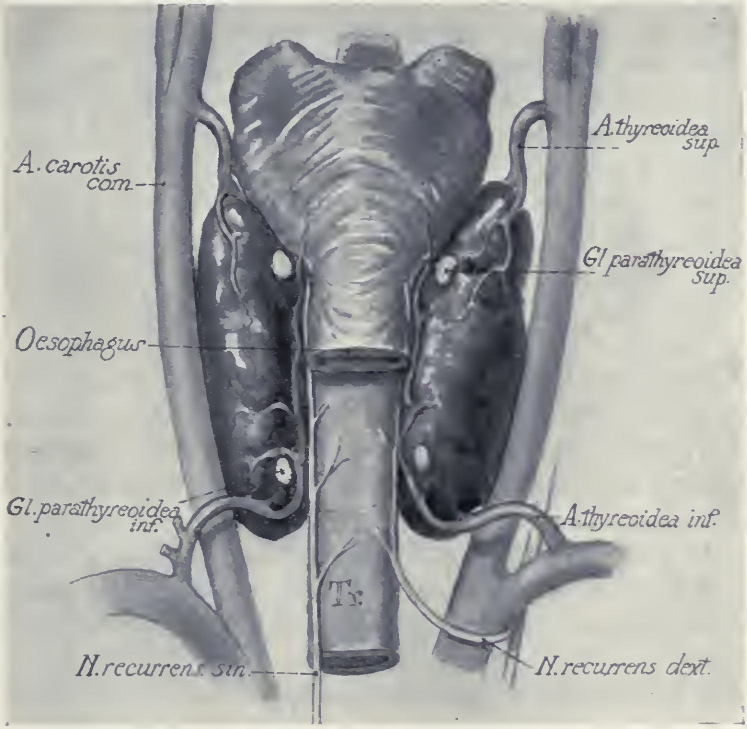

Fig. 405.—Anatomic relations of the recurrent laryngeal nerves to the inferior thyroid arteries at the so-called "danger zone" (as viewed from behind).

It has been found in animal experimentation that these transplanted parathyroid glands are much more likely to grow and to function in cases in which their secretion is needed than in those in which the remaining glands are sufficient to supply the physiologic demands, hence it usually requires bridging over with calcium lactate for only a relatively short period; in our experience not more than two or three weeks.

If the inferior thyroid vessels are ligated during the operation of thyroidectomy the direct or indirect injury to the inferior parathyroid gland can, of course, be avoided by grasping the lower pole of the lobe of the thyroid gland from without inward and upward so that the vessels are included in the bite of the forceps together with the substance of the thyroid gland, provided one is careful to place the forceps so that every portion of the tissue compressed is in front of the posterior capsule of the thyroid gland, because this will compress the thyroid artery at a point beyond the portion from which the branch supplying the parathyroid gland is given off.

Moreover, by following this rule the surgeon also avoids injuring the trachea and the recurrent laryngeal nerve because these structures also lie behind the posterior capsule of the thyroid gland.

What has been said concerning injury to the inferior parathyroid gland when the inferior thyroid vessels are ligated at the most convenient point, namely, where the inferior thyroid artery crosses the recurrent laryngeal nerve near the trachea, applies equally as regards injury to the recurrent laryngeal nerve and injury to the trachea.

In the cadaver it is a very simple matter to recognize the recurrent laryngeal nerve at this point in the form of a white threadlike structure, and even in the living subject this can be done, if the field is kept perfectly dry, by carefully picking up even the smallest vessels and ligating at once, but even the irritation caused in making the manipulations necessary to expose the recurrent laryngeal nerve may suffice to cause at least temporary paresis or paralysis.

The question then arises, Why not in all instances in which one desires to ligate the inferior thyroid vessels follow the plan of ligating in front of the posterior capsule of the thyroid gland?

It seems clear that where the ligation is a step in the operation for removal of a lobe of the gland that this is the plan one should follow.

In patients, however, whose condition makes so serious an operation as even a partial thyroidectomy contraindicated, the amount of traumatism incurred by this method is so severe that one should look for a method which is equally efficient, equally safe against secondary complications, and which subjects the patient to a smaller amount of trauma, and which at the same time will be much more effective than if the ligation is made as in subtotal thyroidectomy just described.

For all cases, then, in which the surgeon desires to reduce the amount of hyperthyroidism by ligating the inferior thyroid vessels on one or both sides, either alone or in combination with ligation of the superior thyroid vessels, which should always be done at intervals of not less than a week, it would seem proper to adopt a method which is simple, safe, and free from injuring any important structures either directly or indirectly, and which at the same time will be certain to reduce the degree of hyperthyroidism present by reducing the blood-supply to the thyroid gland to the desired degree. The operation for the ligation of the inferior thyroid vessels developed and described by Professor Dequervain and practised by him in a large number of cases seems to fill all of these requirements. It has proved eminently satisfactory in our practice at the Augustana Hospital.

It may be well to state here that it is probably best never to ligate more than one vessel at one sitting because a patient whose condition is so serious that it would not be safe to perform a partial thyroidectomy under local anesthesia should be exposed only to the smallest possible strain at any one time, *i. e.*, the ligation of a single vessel under local anesthesia.

The operation can be performed readily under local anesthesia with ½ of 1 per cent. of novocain solution or any one of its equivalents injected opposite the second and third cervical vertebræ in the course of the nerve supplying the tissues involved in the incision in the skin and the space behind the sternocleidomastoid muscle according to the method to be described in detail. The exposure of the vessel is accomplished without pain.

The transverse collar incision of Kocher results in the slightest degree of deformity because it is thoroughly symmetric, consequently it is wise to make the incision in the line to be occupied later on when thyroidectomy is to be performed. The lateral extensions of the incision are about 3 cm. in length and extend a little beyond the outer border of the sternocleidomastoid muscle. After reflecting the flap an incision 5 cm. in length is made along the outer margin of the sternocleidomastoid muscle through the fascia beginning at a point 3 cm. above the clavicle and passing upward and outward in the line in which the Kocher incision will extend later on when a thyroidectomy is made. This portion of the muscle is then loosened from its posterior attachment by blunt dissection down to a point where the finger can feel the pulsation of the carotid artery. At this point the fascia occasionally offers somewhat greater resistance, but one can usually overcome this by burrowing into the depth in front of the carotid artery with the end of the finger until the anterior surface of the common carotid artery has been freely exposed. By passing the finger upward and downward gently, remaining close to the border of the carotid artery, one's progress is interrupted by the inferior thyroid artery usually above the center of the free space in front of the common carotid artery (Fig. 406).

In many cases, however, the inferior thyroid artery has a lower origin and will be encountered in passing the finger downward from the center of the free space in front of the common carotid artery.

At this point it is important to avoid all unnecessary traumatism because the inferior thyroid vein is often very thin walled, and if one is violent in his manipulations it is possible to tear the wall of the vein or even to sever the connection between the deep jugular vein at the point at which the inferior thyroid vein enters this structure. In either case there will be very troublesome hemorrhage, which can best be controlled by pressing outward against the deep jugular vein with the end of the finger until a smooth round-nosed clamp or forceps can be applied to the opening. It is usually best to leave the forceps in place forty-eight hours rather than to attempt the application of a ligature in case the wound is in the jugular vein. If the wall of the inferior thyroid vein has been torn, a ligature should be applied to each side of the tear and the vein cut between the two ligatures.

Although it is necessary to bear the possibility of this accident in mind, it may never occur, and the more constantly one bears the possibility in mind, the less likely it is to occur.

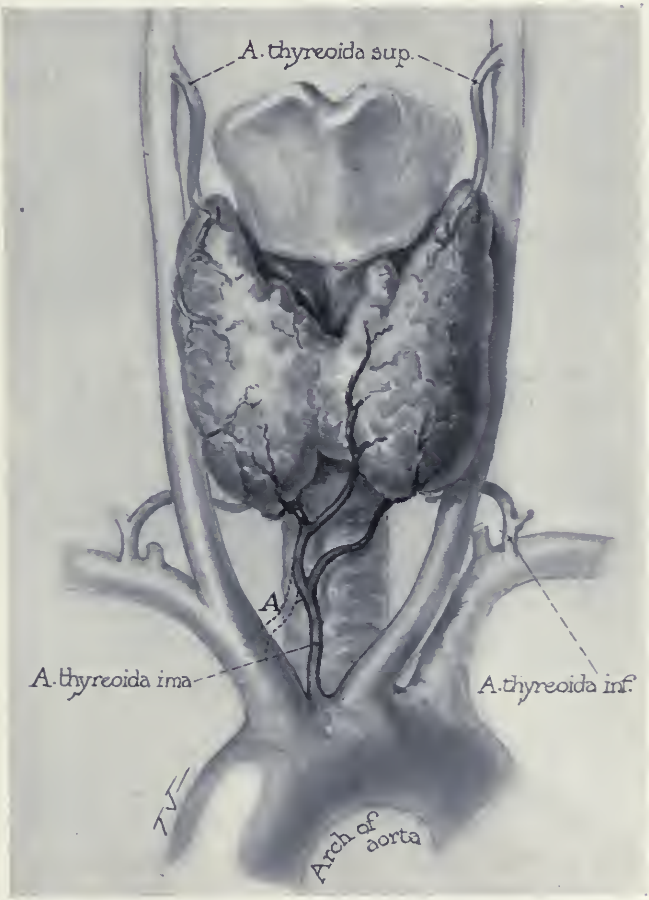

Fig. 406.—The thyroidea ima artery (present in about 10 per cent. of patients) is shown arising from the arch of the aorta. Occasionally it springs from the innominate artery.

After exposing the artery carefully for a distance of 1 cm. from its origin a double catgut ligature is carried behind these vessels with an aneurysm needle, drawn through, and cut so as to make two ligatures. One of these is tied carefully at the point where the vessel comes past the common carotid artery, and the second ligature is tied at a distance of 1 cm. from the first, and the vessel is cut between the two ligatures.

It is better to choose this method than to apply two clamps or artery forceps, cutting between these and ligating, because the former method precludes the inclusion of tissues aside from the vessel and insures against slipping.

After tightening each ligature and before making the second tie of the knot it is well to ask the patient to speak and to request her to cough. The latter is worth while, because patients cannot simulate hoarseness in coughing as easily as in speech. In case of any hoarseness, the surgeon will know that the recurrent laryngeal nerve is in an aberrant position and has been included in the ligature. We have never experienced this accident, but it is said to be possible. In case it should occur, one would, of course, loosen the ligature and carefully inspect the field of operation and shove the nerve to the inner side quite beyond the grasp of either ligature. In case the nerve is not in an aberrant position it is a considerable distance from the point at which these ligatures are applied. The wound is closed at the conclusion of the steps which have been described.

It usually seems wise, because of the condition of the patient, to ligate only the inferior thyroid artery of one side at the first session.

If it is desirable to reduce the blood-supply of the thyroid gland still further the same steps may be repeated on the opposite side after an interval of a week or longer, according to the condition of the patient. In this case it is well to inspect the lower edge of the gland in order to determine the presence of the thyroidea ima which enters one or both or the isthmus from below (Fig. 406) directly in front of the trachea. Occasionally a vein 5 m. or more in diameter may be found in this location. This should be carefully laid free and ligated doubly and cut between the two ligatures.

In case the anterior jugular vein is prominent (Fig. 407) on one or both sides this should be treated in the same manner.

Under normal conditions the anterior jugular vein when compared with the internal and external jugular is so small that it can be recognized only with difficulty, but in the presence of goiter we have frequently encountered this vein greatly enlarged, at times having a diameter of more than 1 cm.

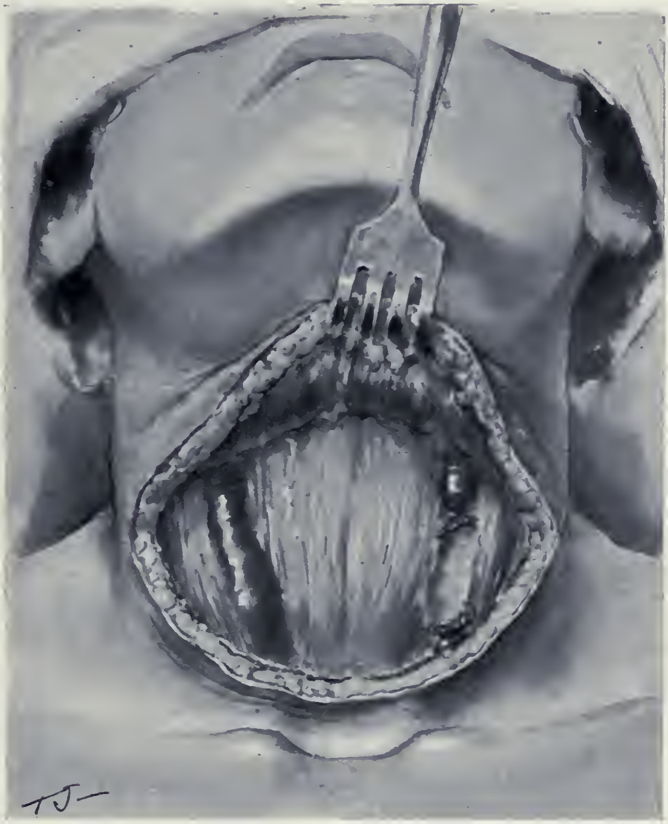

Fig. 407.—The anterior jugular veins when markedly dilated are dissected from their bed, doubly ligated, and severed between ligatures, as shown on the left of the drawing.

Now only the superior thyroid artery and vein remain on either side, and unless one contemplates the removal of one or both lobes of the thyroid gland at the same time, it is usually not wise to ligate either or both of these groups of the superior thyroid vessels at the same sitting at which one ligates the vessels that have been described above, because a patient who has a sufficient amount of resistance to undergo the ligation of several of these vessels at one sitting can readily withstand a subtotal thyroidectomy under local anesthesia. This fact has been reiterated in this paper because it is the one point in which most surgeons are almost certain to commit fatal errors unless their attention has been directed to this danger very specifically.

The object of this paper is to point out the simplicity, safety, and efficiency of this method of ligating the inferior thyroid artery which was first developed and described by Professor Dequervain, of Berne.

There is no danger of injury by this operation to the parathyroid gland, the recurrent laryngeal nerve, or the trachea either directly or indirectly because the field of operation does not approach these structures sufficiently to permit direct trauma, and there is always a sufficient amount of collateral circulation, so that the nutrition of the inferior parathyroid gland will not be interfered with.

There is a definite group of cases of goiter belonging to the variety of exophthalmic and toxic goiters in which this operation is positively indicated.

The group includes cases in which subtotal thyroidectomy must be performed sooner or later in order to obtain a permanent recovery, but in which the condition is such as to make this operation unsafe even after the use of rest and dietetic treatment, or cases in which the improvement is so slow that the operable stage cannot be expected in a reasonable time.

The operation if performed on one side only causes so little shock or depression that it is not likely in any case to reduce the patient's chances for recovery.

Of course, there are patients suffering from goiter so far advanced that there is no chance of recovery, and occasionally one may undertake this operation in one of these cases with a fatal result.

Cases that recover from the little operation, however, as a rule show marked improvement because a considerable proportion of the blood-supply will be prevented from entering the gland following the operation. Usually the benefit is greater from ligating one inferior thyroid artery than from ligating both superiors, and if this method is followed the resulting trauma is less than that resulting from the ligation of one superior thyroid artery.

This operation and, in fact, all operations in patients suffering severely from the effect of diseased thyroid glands should be performed under local anesthesia because general anesthesia in itself is many times more dangerous than this operation in these cases. The following method is in general use in our clinic:

Among the patients presenting themselves at our clinic at the Augustana Hospital for relief of symptoms due primarily to disease of the thyroid gland a recent series of 107 patients had thyroidectomies performed under local anesthesia. During the same period of time from January 1, 1920 to October 30, 1920 we have had the opportunity of comparing the former method with alternating operations done under ether anesthesia. The advantages of nerve-blocking in thyroidectomy are so obvious, postoperative convalescence relatively free from thyrotoxicosis, and the results so gratifying both to the surgeon and patient alike as to warrant a detailed description of the method employed.

Since ether anesthesia must of necessity increase the hazards of operation, and often throw an added burden on the myocardium and nervous system already badly damaged from prolonged hyperthyroidism, all exophthalmic goiters and toxic adenomas were uniformily selected for local anesthesia. The atoxic simple colloid goiters were given the choice of local or general anesthesia.

Experience has proved that the method under discussion possesses the following distinct advantages: 1. The patient can at all times talk to the surgeon, thus abolishing the chance of injury to the recurrent laryngeal nerves.

2. By conversation with the patient his general condition can be accurately determined at any given time. This is extremely important, since Crile has shown that general anes-

thesia fails to inhibit the painful afferent stimuli and only alters their physical interpretation. The position of the patient's head, dyspnea, pressure of instruments on the neck, etc., all may serve as factors whose summation lead up to surgical shock. With nerve-blocking these afferent sensory stimuli are cut off and the central nervous system protected.

3. The dissection of the skin-flap is more quickly and easily done since the subcutaneous tissues of the neck are thickened, due to the inhibition of the solution injected.

4. Local anesthesia demands extreme gentleness of manipulation, sharp, clean dissection, and minimal trauma of the tissues—factors in general essential to good surgery.

5. The patient takes liquid nourishment by mouth immediately after operation, thus eliminating proctoclysis, which is disturbing to nervous toxic individuals.

6. Postoperative nausea, vomiting, and wretching are practically eliminated, and with them the tendency toward hemorrhage.

7. The preliminary dose of morphin benumbs the patient's cerebration sufficiently to largely eliminate the fear of the operation and the transitory increase in pulse-rate.

8. With carefully prepared solutions, healing occurs by primary intention in 100 per cent. of cases.

9. Postoperative bronchopneumonia as a sequel of operation is unknown.

10. The incidence of postoperative thyrotoxicosis has, in our experience, been markedly diminished.

11. Finally, the use of local anesthesia brings the operation to those extremely toxic individuals who could not withstand general anesthesia.

The adult patient receives a preliminary hypodermic injection of morphin, gr. $\frac{1}{4}$, combined with atropin sulphate, gr. $\frac{1}{150}$, two hours prior to operation, and a second hypodermic injection of morphin, gr. $\frac{1}{6}$, with atropin sulphate, gr. $\frac{1}{150}$, one hour before operation. He is placed on an operating table in a quiet side room. The head and eyes are now covered with a sterile towel. The skin of the neck, chin, and suprasternal region is cleansed with alcohol, carefully dried, and painted with 3½ per cent. tincture of iodin.

The solution employed may be freshly prepared as follows:

Apothosene[1] (Parke, Davis & Co.)	gm. 0.6 = gr. 7.5
Sodium chlorid	gm. 0.8 = gr. 12
Aqua destillata q. s. ad.	100 c.c.

After adding the apothosene and sodium chlorid to the sterile distilled water, the solution is slowly brought to boiling for three to five minutes to insure absolute sterility. The entire quantity of 3½ ounces may be accepted as the average amount to be injected, although we have on numerous occasions employed twice this amount of the solution in ½ per cent. strength without noting any immediate or subsequent deleterious effects. The sodium chlorid solution is added with the definite purpose of approximating a physiologic saline solution of the same osmotic tension as the blood, since local necrosis, irritation of the skin-flaps, and delayed healing are known to follow the injection of distilled water in large amounts. Adrenalin solution (1 : 1000), minims 10 per 100 c.c., may be added after preliminary boiling, which, due to its vasoconstrictor action, both prolongs and intensifies the degree of analgesia. It possesses, however, this distinct disadvantage: the intense ischemia of the operative field leads to a false sense of perfect hemostasis with possible subsequent hematoma formation. Furthermore, when using adrenalin in the solution, analgesia develops more slowly, and it is desirable to wait thirty minutes before operating. Without the adrenalin anesthesia is complete within three to five minutes after injection. Its duration varies from one to two hours in the average patient.

Technic of Injection.—The usual preparations completed, local anesthesia is effected by employing a combination of two different methods: 1. By the intradermal and subcutaneous injection of the apothosene solution along the proposed curved skin-flap incision, *i. e.*, the usual "Kocher collar incision"—the method of infiltration analgesia (Fig. 411).

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[1] More recently we have employed procain in ½ per cent. solution with equally satisfactory results. It would seem that the American substitutes for novocain are at present eminently satisfactory.

2. By injection of the solution into or adjacent to the site of the nerve-trunks supplying the operative field—regional

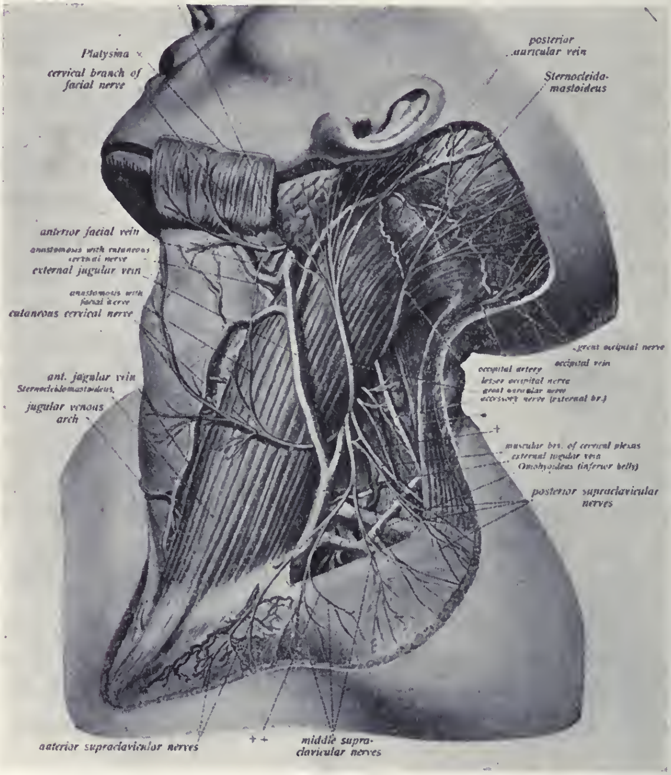

Fig. 408.—The cervical plexus (after Sobotta and McMurrich). The large superficial cervical nerve (nervus cutaneous colli) arises from the second and third cervical nerves and passes transversely across the sternocleidomastoid muscle at about its midportion. At the anterior border of the muscle the nerve divides into superior and inferior branches, supplying the skin of the anterolateral surface of the neck from the chin to the suprasternal region.

anesthesia or nerve-blocking. The cervical plexus (Fig. 408) of nerves on each side of the neck is blocked by passing the long blunt needle on the base of the finger through the skin down to the posterior border of the sternocleidomastoid muscle at about its midportion. Here the large superficial cervical nerve (nervus cutaneous colli) (Fig. 410) arising from the second and third cervical nerves passes transversely across the sternomastoid

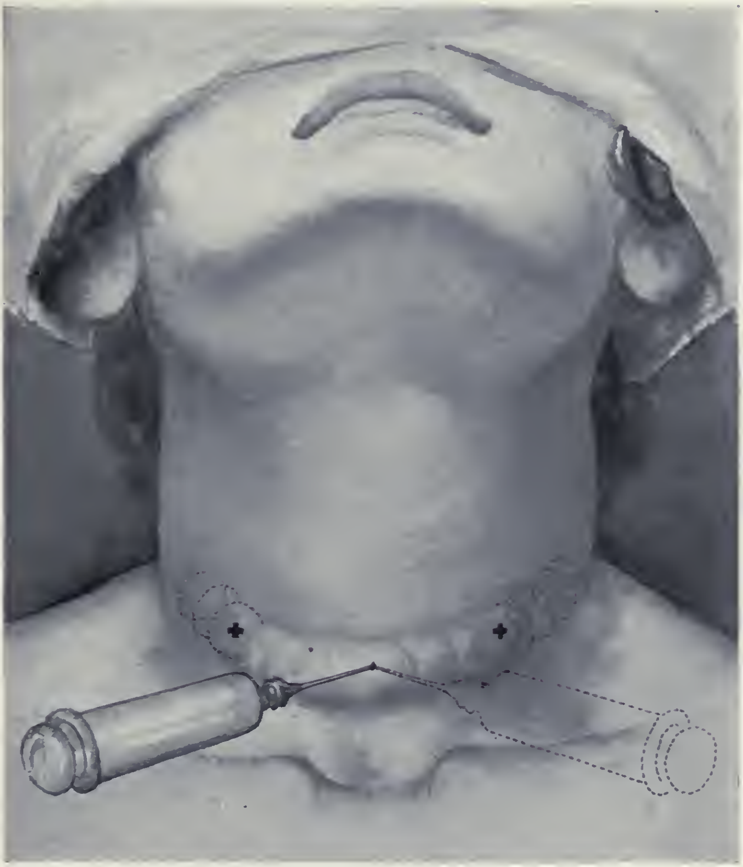

Fig. 409.—Intradermal and subcutaneous infiltration of the procain solution along the proposed Kocher collar incision. The entire infiltration may be performed through three needle puncture wounds.

muscle to reach the anterior triangle, under cover of the platysma and the external jugular vein. It divides at the anterior border of the sternomastoid muscle into superior and inferior branches supplying the skin of the anterolateral surface of the neck from

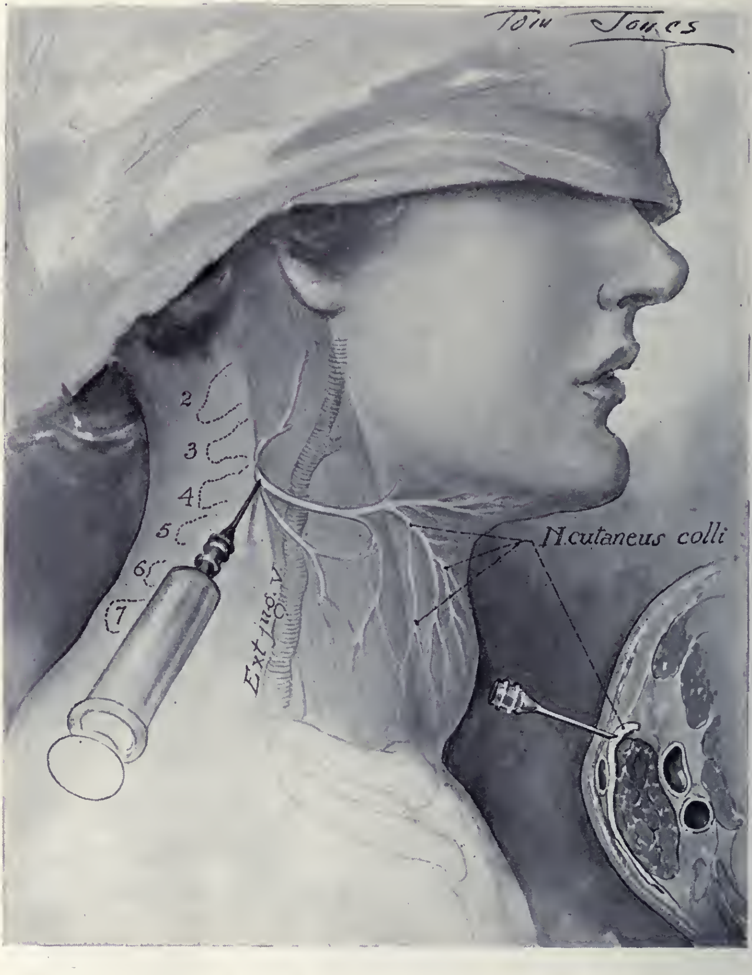

Fig. 410.—Blocking the nervus cutaneous colli at the posterior border of the sternomastoid muscle. The exact location of this nerve is accurately determined by rotating the patient's head to the opposite side, thus tensing the fibers of the mastoid muscle. Pressure with the finger along the posterior border occasions distinct pain when the nerve is impinged on. The insert shows a cross-section of the neck at the level of the nerve. Note that the thick belly of the sternomastoid muscle adequately protects the deep vessels of the carotid sheath.

the chin to the suprasternal region. The exact location of the nervus cutaneous colli is easily determined by rotating the patient's head to the opposite side, thus tensing the fibers of the sternomastoid. Pressure with the finger along the posterior border at about the midportion occasions distinct pain when the nerve is impinged on.

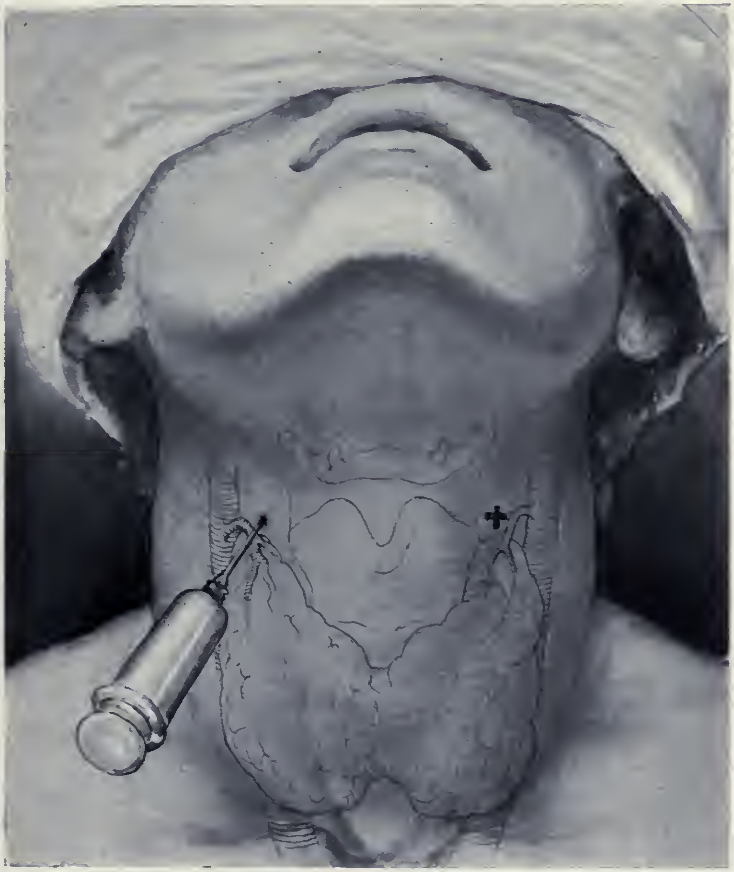

Fig. 411.—Infiltrating the carotid pockets to block the sympathetic fibers coursing along the superior thyroid arteries into the upper poles of the thyroid gland.

The sympathetic nerve-fibers supplying the thyroid gland arise from the middle and inferior cervical ganglia and pass along the thyroid arteries. Accordingly, it is important to infiltrate the two pockets at the upper poles of the lateral lobes in the region of the carotid triangles (Fig. 411). To insure complete blocking relatively large amounts of solution must be injected into the sites designated in the accompanying illustrations. Because tactile sensation may occasionally persist although the loss of pain sensation is complete, we might employ the term "analgesia" in preference to anesthesia.

Group I		
Primary exophthalmic goiter (hyperplastic toxic)	Mild	6
	Moderately toxic	8
	Extremely toxic	14
	Number of patients	28
Group II		
Toxic adenomata	Degenerating colloid adenomata	40
	Substernal adenomata	0
	Subclavicular adenomata	7
	Intrathoracic adenomata	2
	Fetal adenomata	2
	Number of patients	51
Group III		
Simple colloid goiter (hyperplastic non-toxic)	Number of patients	27
Group IV		
Subacute strumitis	Number of patients	1
Total number of thyroidectomies (nerve blocking)		107
Operative mortality (percentage)	*No deaths*	

Fig. 412.—Analysis of 107 subtotal thyroidectomies performed under local anesthesia.

The operative field is now prepared with $3\frac{1}{2}$ per cent. tincture of iodin, sterile towels arranged, and the head of the table elevated to an angle of 45 degrees. Analgesia is complete within five minutes, so that delay is not desirable as when using the adrenalin in the solution. The anesthesia persists for periods varying from one to two hours, allowing far more than ample time for the most difficult case. We have seldom found it necessary to make an additional injection of the solution after the operation is begun. The entire operation is absolutely painless.

It is, however, well to bear in mind the fact that patients usually experience a transitory choking or sensation of suffocation when the lateral lobes are luxated or manipulation in enucleating the lobes occasions pressure on the trachea. Aside from this transitory discomfort the patient commonly offers the information that the operation was painless even in the largest types of goiters.

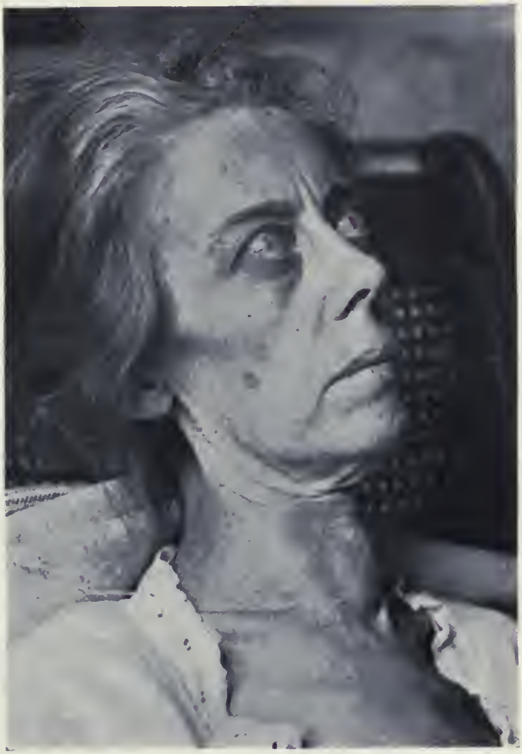

Fig. 413.—Patient with a toxic exophthalmic goiter. Subtotal thyroidectomy under local anesthesia to protect the myocardium and central nervous system.

An analysis of the case histories of 107 thyroidectomies (Fig. 412) performed under local anesthesia shows that 28 of the patients had radical operation for primary exophthalmic goiter (Fig. 413). With few exceptions the typical case gave a history of slight thyroid enlargement associated with mild toxic symptoms extending over a period of several months. The onset was sudden and gradually the thyrotoxicosis increased up to the latter part of the first year, when a crisis developed. Six of these patients were classified as mild, 8 were moderately severe, and in 14 cases the disease was associated with exophthalmos, tremor, weight loss, excessive sweating, and vasomotor phenomena together with tachycardia and varying degrees of involvement of the myocardium and central nervous system.

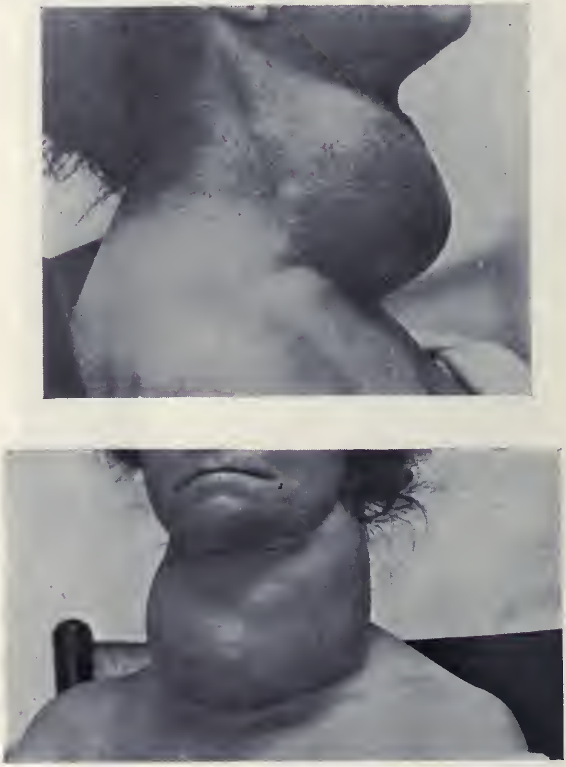

Fig. 414.—Large colloid adenoma removed painlessly under local anesthesia.

This group consisted of 26 females and 2 males. The average duration of symptoms was one year—the earliest six weeks and the longest two years.

The average age of the patient was thirty years. The youngest was nineteen years of age; the oldest, fifty-one years. Rest in bed and preliminary medical treatment was instituted in all the severely toxic cases prior to operation. Three patients had double ligations preliminary to lobectomy. Six hyperplastic toxic goiters had a secondary radical operation for recurrence of symptoms coincident with compensatory hyperplasia of the thyroid gland. Four of these patients had received the primary operation elsewhere; 13 patients had chronic disease of the tonsils with tonsillectomy. In 6 instances the tonsils had been previously removed. Among the remaining 9 patients the tonsils appeared normal.

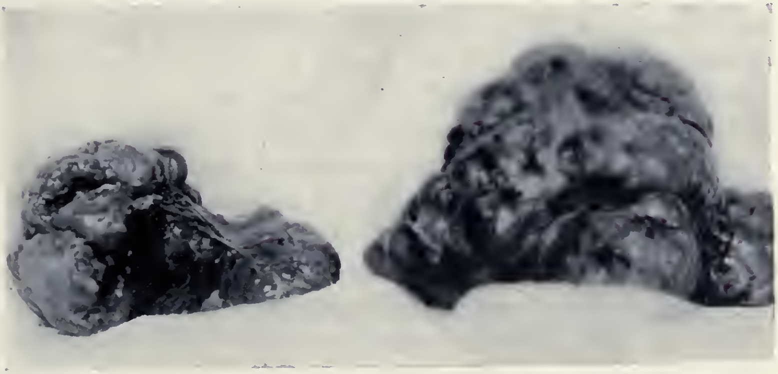

Fig. 415.—Thyroid gland of patient shown in Fig. 414. The largest colloid goiters and even the substernal adenomata may be painlessly removed if the anesthesia is carefully done.

Early operation is essential in treating these toxic patients, since with each crisis additional damage is inflicted on the heart and nervous system, until finally the patient, even though cured of the goiter, is left permanently wrecked from the secondary degenerative processes. The operative risks in this class of patients Plummer states "are evident largely in the case of patients who have been hypertrophied more than a year."

The group of 49 toxic adenomata (Figs. 414, 415) present relatively typical histories and form a large and interesting class of goiter patients. In contrast with the exophthalmic goiter the onset is insidious and the patient states that the goiter was present usually several or many years before the onset of toxic symptoms. This class comprises 46 females and 3 males. The average age was forty-two years. The youngest patient was twenty and the oldest sixty-two years. The average duration of the goiter was noted to be eleven and a half years. Two patients had goiters for thirty years before toxic symptoms supervened. The average duration of toxic symptoms was one year—the longest three years and the shortest two months before operation.

Seven of these patients had substernal or subclavicular adenomas. In 2 cases operation revealed an intrathoracic adenoma which was removed under local anesthesia without severe hemorrhage and the cavity was immediately lightly packed with gauze before rupture of the pleura and pneumothorax could result. In both instances the anterior group of neck muscles were hypertrophied, presumably, as Lahey has pointed out, to guide and direct the adenoma downward through the superior thoracic aperture. The diagnosis of intrathoracic goiter rests largely on the history of respiratory obstruction combined with a widening of the upper sternal shadow in the roentgenogram and frequently a lateral bowing or deviation of the trachea.

Of the 27 hyperplastic non-toxic colloid goiters operative treatment was sought for relief of dyspnea, dysphagia, sensations of pressure on the trachea, or, as in several cases, for unsightly tumefaction of the neck. There was one instance of subacute strumitis.

All patients are given liquid nourishment by mouth immediately after operation, permitted to sit up on the second day, and discharged from the hospital at the end of one week. There were no deaths in this series of 107 consecutive thyroidectomies under local anesthesia.

In conclusion, we would emphasize the fact that local anesthesia is essentially the method of choice in all toxic goiters, and its advantages over ether anesthesia are many. Furthermore, the treatment of by far the larger number of toxic goiter patients is surgical, and the best treatment consists of early operation at a time before the myocardium, nervous system, and other vital organs are permanently damaged.

CLINIC OF DR. JOSEPH B. DELEE

Chicago Lying-in Hospital

ACUTE APPENDICITIS IN PREGNANCY AT TERM

Summary: Report of 2 cases of acute appendicitis in pregnancy at term. Differential diagnosis between appendicitis and other abdominal lesions. Treatment to be employed. Obstetric conduct of the case where appendicitis occurs in the eighth and ninth months of pregnancy. Mortality of appendicitis in pregnancy.

Acute appendicitis is met during pregnancy with probably no more than usual frequency. In the last few weeks of gestation and during labor it is very rare. I have had one instance of it in thirty years of my private practice, and 3 other cases in consultation, occurring in very late pregnancy. Two of these 4 cases will be reported here for the first time.

Case I.—Mrs. S., physician's wife, aged twenty-three, primipara. Her previous history was inconsequential except that she was of somewhat hysteroneurotic temperament. She was operated during the fourth month of pregnancy for a simple, non-infected mucous cyst of the Bartholin gland. It was done under novocain, without trouble. Nine hours later, during a violent coughing attack, a hematoma of large size suddenly developed in the labium majus, extending upward alongside the vagina for 4 inches. Under ether the bleeding vein was tied and the cavity packed (because of oozing). She made an uneventful recovery.

Labor was expected May 13, 1920. On May 8th at 6 A. M. the patient complained of epigastric pain, which increased in intensity and was soon followed by vomiting. At noon she entered the hospital. Her pulse was 92, temperature 97° F., and respiration 20. The first examination showed a sick woman, not hysteric, with a pulse of 72, temperature 98° F. and respiration 22. An enema had been given, with the result of a considerable amount of feces, a small amount of mucus, and very little flatus. A catheterized specimen of urine, 6 ounces, showed a very heavy trace of albumin, no casts, no pus, no ureteral elements, epithelium. Blood-pressure 116/60. The heart and lungs, skin, tongue, organs of special sense, and reflexes were negative. The abdomen was much distended; child was estimated a large one—cephalic presentation, O. L. A. There was general tenderness all over the belly, but the patient complained of pain, mostly in the epigastrium. Later in the afternoon the pain diminished over the stomach and localized high up in the right side. The tenderness was found over the epigastrium and just below the location of the gall-bladder, extending downward to the level of the navel. Pressure on the left side of the uterus evoked pain on the right side of the belly, midway between the ribs and the level of the navel, and here was the point of greatest tenderness. There was but slight difference in the abdominal rigidity on either side, but the muscles favored the right, if any. There was no pain to be elicited in either kidney or the ureters—however, pushing up the kidney caused pain at the point mentioned before. The stomach was distended with gas. Labor-pains were not present and there were none of the symptoms or signs of any obstetric complications, *e. g. abruptio placentæ*, rupture of the uterus, ectopic gestation, nor any indication of intra-abdominal hemorrhage.

The diagnosis lay between acute appendicitis, an acute gall-bladder, salpingitis, pyelo-ureteritis, and intestinal obstruction.

The type of onset of the disease, the absence of fever, the unilateral location of the pain and tenderness, the negative history (no gonorrhea, no influenza, etc.), the evidently severe attack pointed away from salpingitis, while the same findings and the negative result of urine analysis and kidney and ureteral palpation eliminated the latter organs. I would like to stress the point of differential diagnosis between ureteritis, stone or ureteral kink, and appendicitis. It is usually not easy, and many mistakes have been made in confounding one with the other.

There remained the gall-bladder, the appendix, and the obstruction. Even though the pains did not come in colicky waves, and run through the body to the back and up into the shoulder—qualities which are usually found with cholecystitis—the gall-bladder was kept in mind. The absence of fever and the quiet pulse (72) permitted us to await developments.

During the afternoon the vomiting was repeated twice. In the evening the temperature rose to 100° F., the pulse 104, and the patient felt chilly. The white blood count showed 9000. The pain and the spot of greatest tenderness now became localized near the right uterine cornu. The distention had not increased and the vomiting had ceased, wherefore obstruction of the bowel was ruled out. When the patient took a deep inspiration the pain began only at the end of it, and tapping pressure on the gall-bladder was less painful than over the appendix.

When, at 10 P. M., the temperature rose to 101.2° F., the white blood-cells to 11,999, and the pulse to 110 a positive diagnosis of appendicitis was made.

Eighteen hours after the onset of pain the abdomen was opened. The incision, because of the large uterus, and the location of the pain and tenderness, was made much higher than usual, namely, about half-way between the usual gall-bladder and appendix areas. It had to be 6 inches long. The tube and ovary were normal, but the peritoneum was deep red, and a small amount of cloudy serum was already present. The cecum was raised very high and pushed into the flank by the large uterus.

After much trouble (because of the immense uterine tumor) the appendix was found. It was alongside the spine, with its apex pointing to the hilum of the right kidney, with a short, fat, inflamed mesentery. It was 5 inches long, as thick as one's little finger, deeply reddened, covered with plastic exudate, and two areas on it had necrosed, but not perforated. The large uterus was held to the left by means of a large Deaver liver retractor covered with a lap.-pad, the appendix removed, and the stump inverted into the thick cecum, using fine silk. The abdomen was closed as usual in clean appendectomies, without drainage.

Morphin and scopolamin were administered to stop uterine action, as we wished labor delayed as long as possible.

Recovery was uneventful, but on the fifth day labor-pains began. Dilatation was complete in five hours, whereupon ether was administered to stop bearing-down efforts, a deep perineotomy done, and the child delivered by forceps. There was a smart uterine hemorrhage which necessitated the removal by hand of thick edematous decidua and retained membranes. The uterine wall was edematous. Emptying the uterus, together with ergot and pituitrin, failed to control the flow of blood, and therefore the uterus was firmly tamponed. The perineotomy was repaired as usual.

The baby weighed 8 pounds. On the second day after the removal of the gauze there was a gush of clear fluid from the uterus, evidently blood-serum. It seems that the uterus took part in the general inflammatory intra-abdominal conditions. Mother and child made a perfect recovery.

Case II.—Mrs. P., about eight and a half months pregnant, para II, entered hospital with indefinite abdominal pains, said to be labor-pains. Her temperature was 97° F.; pulse, 100; respiration, 22. After admission there was a good bowel movement with enema. During the night the nurse recorded uterine contractions of moderate strength every three minutes. Early the next morning patient vomited freely, the pulse had risen to 120, the temperature was 98.8° F., and the woman complained of a severe pain in the right side. A catheterized specimen of urine showed a trace of albumin, no sugar, no casts, no pus, no ureteral elements. I saw her for the first time at 11 A. M.

The only difference from the other one that this case presented was the sharp localization of the pain and tenderness, both of which were in the classical area for appendicitis—perhaps a few inches higher than usual. The white blood-cells were 14,250, blood-pressure 128/70.

At 2 P. M. the temperature was 98.6° F., pulse 100, respiration 24, not abnormal, but the patient had begun to vomit and the pain had increased markedly. There was excessive tenderness over the whole right side of the uterus.

At 5 P. M. the belly was opened with the usual flank incision, but longer and a little higher. Seropus was present and the enlarged red necrotic appendix came at once into view. The uterus was held to the side with a liver retractor. In delivering the appendix it burst, emitting some acrid, foul-smelling pus. It was as thick as the index-finger, the cecum was also thick and edematous, wherefore it was impossible to bury the stump. A gauze drain covered with a rubber glove was led down to the cecum and the belly closed.

In spite of large doses of morphin labor came on the next afternoon. In one hour the child was born, a girl weighing 6 pounds, deeply narcotized. There was no hemorrhage. About six days later a fecal fistula developed, otherwise the recovery of both mother and child was undisturbed. The fistula closed spontaneously in a few weeks.

Many hours could be consumed discussing the various aspects of these 2 cases, but we will be limited to those which are most important from a clinical point of view.

First and foremost, here as always, diagnosis is *the* thing. In describing the cases we went thoroughly into this. A few general remarks may not be out of place.

Whenever a pregnant woman develops a complication, the first question we ask ourselves is, Does this complication belong to the pregnant state, or is it surgical or medical? In other words, Is this a disease *in*cidental or *ac*cidental to pregnancy? A recent experience in consultation will explain my meaning.

A woman was delivered at the eighth month of pregnancy by accouchement forcé, the indication being hyperemesis gravidarum. She had vomited almost continuously for ten days and did not improve after the uterus was emptied. Upon examination the vomitus was found to be fecal, and the distended gut could be seen in peristaltic hyperaction leading to the right iliac fossa, the site of her appendix operation years before. Laparotomy revealed a double kink of the bowel at this point. The patient recovered from the operation. This woman had a purely surgical complication. The fact that the vomiting did not cease after the uterus was emptied indicates that in all probability the pregnancy had nothing to do with the acute intestinal obstruction. At least the complication was one which a man could have had.

Another case will illustrate the reverse of this picture. Dr. J. B. Murphy, of sainted memory, referred to me a case that had been sent to him as one of acute intestinal obstruction. The woman had been vomiting continually for over two weeks. At that time Dr. Murphy was making routine Abderhalden tests, and the fact that this patient showed a strong positive reaction led him to make a vaginal examination, whereupon he discovered the pregnancy. It was a true, ultimately fatal, hyperemesis gravidarum. Had the toxic condition been early discovered this life might have been saved.

In the 2 cases of appendicitis it was easy to eliminate diseases incidental to late pregnancy. Eclamptic toxemia sometimes begins with vomiting and epigastric pain, but in neither of these women were there any urinary findings, or high blood-pressure, or excessive exaggeration of the reflexes, or edema, or any of the usual symptoms and signs of toxemia. Torsion of the uterus, rupture of the uterus, *abruptio placentæ*, ectopic gestation, all diseases incidental to pregnancy, were easily ruled out—their classic symptoms were absent. It was plain that we had to deal with a disease accidental to pregnancy. It is not necessary to repeat how we decided which one it was —we developed this point in the case histories.

After the diagnosis is made the next thing to do is to decide on the course of treatment. In view of the bad prognosis of appendicitis in pregnancy this rule should be observed: Operate as soon as the diagnosis is made, and make the diagnosis as early as possible.

It is generally conceded by those who have studied the subject—Murphy, McArthur, Schmid, Wagner, *et al.*—that the pregnant state aggravates the dangers of appendicitis many-fold. Gangrene and perforation are more rapid. The peritonitis is more wide-spread and more virulent, the reactive forces are less strong, the toxemia more often fatal. Protective adhesions are less likely to be formed, the omentum and gut being pushed away by the enlarging uterus; the inflammation is more stormy, owing to the intense vascularity of the parts; thrombosis and phlebitis are more common; suppuration takes place higher in the abdomen (true of late pregnancy), which portion is recognized to be less resistant; drainage is less free owing to the large uterus near by, and the abscesses burrow deeply in all directions; tympany compromises the respiration sooner, also pneumonia and pleurisy; obstructive symptoms arise earlier; and the bacteria floating in the blood may accumulate in the placenta, and even the fetus, causing abortion and sepsis. The mortality in the early months (while greater than the mortality of non-pregnant cases) is not as high as after the seventh month, when it may be as bad as 40 per cent.

Whether or not the presence of pregnancy should alter the surgical treatment of the case is a disputed point, and no one operator has enough experience in such cases to enable him to make hard-and-fast rules of action.

In a general way it may be said that up to the fifth month the pregnancy gives no indication for an alteration of the usual method of treatment of appendicitis. I have already stated that early operation is the invariable rule, and that while individualization of appendicitis cases in men and in the non-pregnant state, as to operation or expectancy, may be permitted to an acute and experienced observer, during pregnancy, even in cases of doubt, it is better to operate.

The location of the incision in the first five months also is the same as usual. I prefer the right pararectal incision for appendix operations in women. One can, if necessary, do something to the tube and ovary on the other side, and hernia does not often follow it.

It is best to remove the acutely inflamed appendix if at all possible. Cases are very rare in which one may not spend the few extra minutes in searching for the appendix. Naturally, if there is extensive general peritonitis, and the woman's condition is grave, one should only open and drain freely.

As regards drainage, we are using this less and less, following the trend of the general surgeons. We are discussing cases before the sixth month, and the changes in the uterus, the peritoneum, and the pelvic connective tissues are not so far removed from the normal. We find that we can trust a great deal to the peritoneum, and some surgeons, even after an abscess has formed, remove the appendix, swab out the pus, and close the abdomen. Later, if the symptoms do not subside, it is a simple matter to reopen the wound to provide drainage. Whether or not it is safe to do this during pregnancy we need more experience to determine. In early pregnancy it is safer than later. In early pregnancy the question of emptying the uterus does not come up. Should, however, abortion occur, in spite of morphin and rest, we interfere as little as possible and favor the spontaneous emptying of the uterus by tamponade, quinin, and, later, pituitrin. Manual curetage, because of the necessary abdominal manipulations, is replaced by instrumental, and the uterus is not dragged down—all this to prevent tearing of new protective peritoneal adhesions.

The cases occurring during the sixth and seventh months begin to partake of the dangers and technical difficulties of appendicitis in the last dimester, and require more drastic treatment. Operation as soon as the diagnosis is made is the rule. The incision is made a little higher and more in the flank than usual. The large uterus is a little more in the way and requires care in handling (to avoid abortion). The appendix should be removed (unless inaccessible). I believe one may not trust as much to the powers of the peritoneum; therefore one will drain oftener than in the last-mentioned class of cases.

The question of emptying the uterus does not arise in the sixth month, it may in the seventh month, and will be discussed in a few moments.

Appendicitis in the eighth and ninth months gives the largest number of problems to solve, because here, together with those of a purely surgical nature, we have those of the obstetric conduct of the case. In the 2 cases cited the following plans were considered: 1. Remove the appendix, close the belly, give morphin to prevent the coming of labor. 2. Remove the appendix after doing a classic cesarean section. 3. Do a low extraperitoneal cesarean section, close the incision, then remove the appendix. 4. Porro-cesarean and appendectomy.

Vaginal cesarean section and induction of labor with delivery from below were not entertained at all, as in both cases the local conditions were not favorable.

Porro-cesarean was not selected in either case because (1) the women were young and should not have been mutilated; (2) the appendicitis was early diagnosed (eighteen and thirty hours) and presumably there was little pus and general peritoneal infection; (3) there are not enough cases reported to justify this heroic measure in such mild conditions.

The low, extraperitoneal cesarean suffers from the same lack of precedent, but it appealed strongly to me. Had labor been in progress for several hours, so that the lower uterine segment was distended and retracted upward away from the bladder—conditions which made the cervical operation easier—this method of treatment would certainly have deserved more favorable consideration.

The classic cesarean section followed by appendectomy was at once dismissed as too dangerous. We know that in the very early stage of appendicitis, even when we find a little seropus around the cecum, that the bacteria have not yet invaded the peritoneal cavity. Bacteriologic examination of this seropus is negative. After gangrene has set in, and indeed sometimes before rupture has occurred, the peritoneal exudate is infectious, and always, of course, after rupture. We know that it is very dangerous to open the full term uterus in the presence of pus. Indeed, when we have to do this it is considered good surgery to remove the uterus. Therefore, since we cannot know when the peritoneum is sterile, it is wise not to open the uterus before or after appendectomy. If we can do the cesarean extraperitoneally it is a different matter.

In the discussion of the selection of the mode of delivery—

e. g., whether vaginal or abdominal—adjuvant conditions must be consulted—*i. e.*, contracted pelvis, primiparity or multiparity, the state of the cervix, the strength of the mother, etc.

Finally, we come to the method actually adopted, and you must admit the end justified the course of procedure. In the first case we did not drain, and the wound healed by primary union. Perhaps we might have done a cesarean here with safety—and perhaps not. Labor did not come on for five days, and therefore the peritoneal adhesions must have been quite firm and the local immunities well developed because, in spite of the fact that I had to remove the placenta manually and pack the uterus, all this manipulation was followed by no signs of peritonitis.

In the second case the gangrenous appendix burst in my hand and the thick sodden cecum prevented proper management of the stump. I drained with rubber-covered gauze, which the event proved was a good measure because a fecal fistula resulted. Labor came on the next day, but since the abscess was well drained the excursions of the uterus did not spread the pus. Fortunately, this case did not require any local manipulations.

CLINIC OF DR. HERMAN L. KRETSCHMER

PRESBYTERIAN HOSPITAL

HYPERNEPHROMA OF RIGHT KIDNEY

Summary: A woman of sixty-three years presents herself for examination because of hematuria and pain on the right side. Physical examination and laboratory findings justify a diagnosis of hypernephroma, which was verified at operation. Discussion of hypernephromata; differential diagnosis.

WE have for operation this morning a woman aged sixty-three, whose previous history is negative. Her family history is without significance except that her father died of kidney trouble at the age of seventy-eight and one brother died of pulmonary tuberculosis. Her present complaints are *hematuria*, *pain on the right side*, and attacks of *asthma*.

Hematuria was first noted in September, 1920 and lasted only one day. The second attack occurred shortly after the first and lasted for a week. There was no pain associated with the hematuria. The third attack occurred several weeks later. The blood was mixed with the urine and the urine had a bright red color. At times the patient passed clots. Upon admission to the hospital she stated that the hemorrhages occurred about once a week.

Pain in the right side: These attacks of renal colic began about one month ago. The pain begins in the right lumbar region and is sharp, severe, and gnawing. It radiates into the right groin, and occasionally she has twinges of pain in the right side, associated with tenderness.

For ten years the patient has suffered from attacks of *asthma*, occurring in the winter. These attacks are associated with dyspnea. The patient coughs up large amounts of milky fluid.

There is slight burning on urination, but no frequency. The patient has not lost weight and thinks she has gained some recently.

Physical Examination.—The patient is a large woman, in apparently good health. Her head and neck are negative except for a few small submaxillary glands on the right side. Her heart is negative. The lungs show a few râles on the first deep inspiration only. The abdomen is negative. There is tenderness over the right kidney and the right kidney is palpable, apparently slightly enlarged and movable. The extremities are negative and the reflexes are normal. Vaginal examination is negative. Blood-pressure is 168 systolic and 90 diastolic.

x-Ray examination for the presence of stone in the urinary tract is negative. *x*-Ray examination of the chest is negative.

The two prominent symptoms in this case that interest us are the presence of blood in the urine and the right-sided renal colic. In any given case of hematuria two fundamental questions present themselves. The first is to determine the origin of the hematuria, and the second is to determine the cause. Hematuria means the presence of an organic lesion in the urinary tract, and if the patient is examined during the time of active hemorrhage the cause for the bleeding can be definitely determined by calling to our aid one or several of the modern methods of urologic diagnosis. Hematuria should never be considered as a passing symptom and without significance, as is so frequently done, because if patients are encouraged to consult a physician the first time that blood is noted, the outlook for curing a patient suffering from one of the various lesions producing hematuria would be very materially increased. As it is, the patients are told that the blood has no significance, and are treated with various medications, and finally are sent to the urologist for diagnosis, only to find that they are beyond relief. In a previous analysis of 200 cases of hematuria, I found that in about 43 per cent. of the cases hematuria was due to the presence of new growths in the urinary tract. If we add to this the cases in which the hematuria is due to stone and tuberculosis, the percentage, as you will see, will run up very high. Our next step, therefore, was to resort to cystoscopy and ureteral catheterization.

Cystoscopic Examination.—The bladder was perfectly normal, as were the ureteral openings. Ureters were catheterized without difficulty or obstruction. From the left ureteral catheter clear concentrated urine was obtained; from the right, bloody urine. Cell counts and cultures were as follows:

	Cells.	Cultures.
Bladder	9,000	Sterile
Right kidney	21,000	Sterile
Left kidney	9,000	Sterile

As a result of the cystoscopic examination we are justified in stating that this patient is suffering from a hemorrhage from the right kidney. This finding fits in very well with her clinical symptoms because she has had attacks of right renal colic and also complains of pain in the region of the right kidney. Our next step in this problem of diagnosis was to determine the cause of the bleeding. As the patient is an elderly woman, it would seem most likely that she is suffering from a malignant tumor of the right kidney. The right kidney is enlarged and easily palpable, and our findings would seem to confirm our provisional diagnosis of tumor. In order to verify our tentative diagnosis of tumor it was thought desirable to carry out pyelography, especially as x-ray examination for the presence of stone was negative.

Pyelogram.—A 15 per cent. solution of sodium bromid was injected into the right kidney pelvis. This showed a filling defect in the upper part of the pelvis and the superior calyx was obliterated. In the upper part of the pyelogram was seen a long, narrow collection of sodium bromid. The upper part of the pelvis appeared to be cupped. The lower calices were markedly clubbed. It would appear that this pyelogram was compatible with the presence of a tumor in the upper pole of the kidney (Fig. 416).

From these findings a diagnosis of malignant tumor of the right kidney, probably hypernephroma, was made, and the patient advised to be operated upon, which advice was accepted. Before doing the nephrectomy it was thought desirable to cystoscope the patient again and to carry out a functional test. Phenolsulphonepthalein test showed the following:

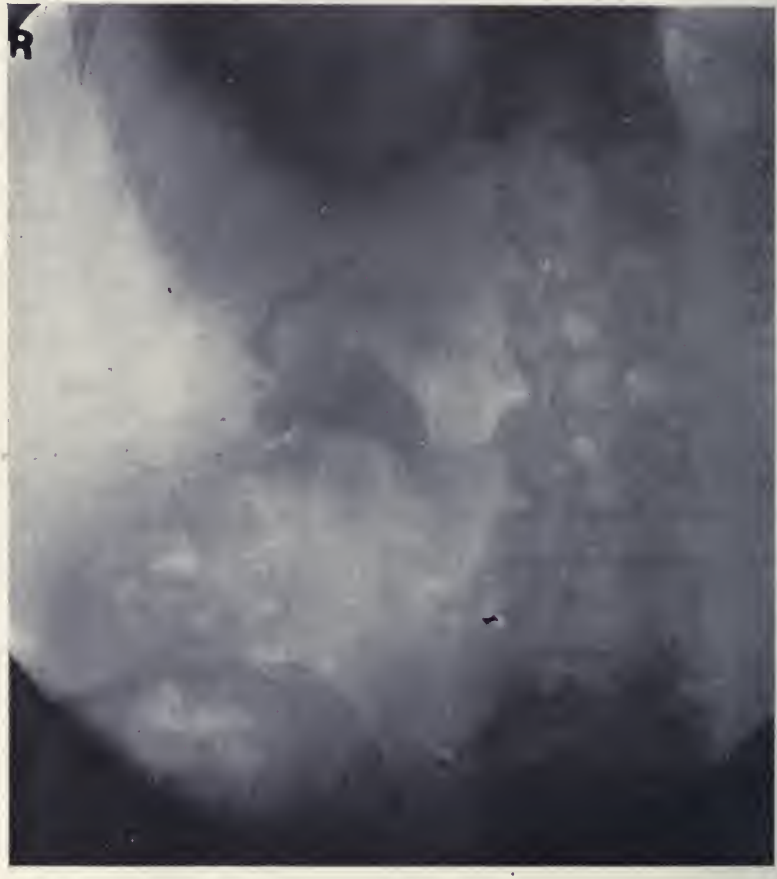

Fig. 416.—Pyelogram showing tumor in upper pole of right kidney.

	Right.	Left.
Time of appearance	11 minutes	3 minutes
Output first half-hour	5 per cent.	20 per cent.
Output second half-hour	12 "	30 "

Having made a diagnosis of right hypernephroma and having advised the patient to be operated upon, we will perform a right nephrectomy this morning. As this patient has a malignant tumor, the usual oblique lumbar incision will be made, and it will be carried far forward in order to insure a large working space. Having divided the muscles, we reach the capsule of the kidney, which is divided. The kidney can be very easily delivered, as there are no adhesions. In the lower pole of the kidney you see the presence of a very large cyst. From its appearance and the character of its contents, it is probably one of the so-called urinary retention cysts. The pedicle of the kidney can be freed very easily and the peripelvic fat can be freed by means of gauze sponge dissection. There is no infiltration of the kidney pedicle and nowhere can I feel the presence of enlarged glands. I will, therefore, remove this kidney. The ureter can, as you see, be easily isolated, and I will divide it between two artery clamps. The lower part of the ureter is tied with catgut. I will now place a clamp across the renal vessels and a second clamp below the first. I will now remove the tumor by cutting the vascular pedicle with a knife. Catgut ligatures will be placed one between the two clamps and one below the second clamp. There is no bleeding from the pedicle after the clamps are removed. The large cavity that remains I will pack with a small amount of iodoform gauze. The cut muscles will be closed in two layers and the skin with silkworm-gut.

We will open this specimen by cutting the kidney from pole to pole. On section it shows the presence of a tumor the size of a large plum, in the center of which are several areas of calcification.

It is evident, therefore, that our preoperative diagnosis of tumor of the kidney, probably hypernephroma, was the correct one.

Hypernephromas are the most frequent of the malignant tumors that are found in the kidney. During the past fifteen or twenty years much has been said and written about hypernephromata. Formerly, as you know, the literature on kidney tumors was in a state of chaos and confusion, and a perusal of the old-time literature shows many conflicting terms that have been used in describing tumors of the kidney. However, since the tumors were described by Grawitz, their relative frequency became apparent at once, and the use of the old terms to describe these tumors no longer abound. There is some question about the origin of these tumors. As you know, it was first suggested that they were due to aberrant adrenal rests. Stoerck, however, questions this view, and Wilson has recently suggested that they be termed "mesoblastomas." Hypernephromata are not always primary in the kidney. Cases have been reported in which the hypernephroma has occurred as a primary tumor in the liver. Hypernephroma may occur in any part of the kidney—in the superior pole, the inferior pole, or in the middle of the kidney. It was formerly thought because of their supposed origin from misplaced adrenal rests that they always occurred in the upper pole. This, however, we know is not true. Many of these cases occur in the lower pole, and in this particular instance the tumor apparently had its origin in the middle of the kidney.

The hypernephromata, more than other malignant tumors of the kidney, have a tendency to grow into the renal vein. To be sure, every large hypernephroma does not show this phenomenon; however, it is generally believed that hypernephromata tend to grow into the renal vein and spread into the vena cava more often than do other malignant tumors of the kidney. As a result of this extension, edema of the lower extremities may develop. If this diagnosis can be made prior to operation it is at once apparent that operation would be useless in such an instance.

Hypernephromata are one of several types of malignant tumors that have the well-known characteristic of producing bone metastases. Not infrequently the patient may have a hypernephroma that has run a symptomless course, and the symptoms that bring the patient to the physician are those due to the metastases, namely, spontaneous fractures of the bones or the presence of metastases in the skull. Hypernephromata also tend to produce lung metastases, and as this patient had a history of asthma with cough, this possibility was considered at once and the chest was subjected to careful *x*-ray examination. This failed to show the presence of anything that could be interpreted as metastatic involvement of the lung. Metastases to the skin may also occur. These skin metastases are apparently of little concern to the patient at first, but because of their increasing size a physician is consulted, who removes the small, innocent looking tumor under local anesthesia. Histologic examination reveals the true nature of the skin tumor, and this is the first intimation of the real condition of the patient.

The **symptoms** of hypernephroma are variable. Hematuria is undoubtedly the most common symptom.

Blood in the urine may be of two types, either gross or microscopic, and while gross blood is not always present, a very definite number of patients upon close questioning will admit that they have or have had attacks of painless, symptomless hematuria. In our patient this symptom was the most prominent of all the symptoms. Not only do these patients have gross blood in the urine, but microscopic blood may be found if a search is made. Not infrequently patients present themselves for examination who have a certain degree of anemia that cannot be explained. If in some of these cases a careful and prolonged search for blood in the urine is made, one will be rewarded by finding a small quantity of blood. Even if this is only microscopic, it may be of definite value coupled with other symptoms and signs. Whether or not a patient passes clots will depend upon the amount of bleeding and whether or not the blood has time to clot in the pelvis or bladder. In instances in which clots are passed down the ureter the patients have more or less typical attacks of renal colic. These attacks of colic differ in no way from attacks of colic due to the passage of a stone down the ureter. In our case the patient gives this rather typical history of renal colic. Sometimes the patients complain of indefinite aches and pains in the back. These may be of two types—pain associated with or due to renal colic and the dull, indefinite pain in the back due to the presence of a tumor.

Cases of malignant disease of the kidney may at times show fever. Though this is not a constant symptom, it does occur. I believe that Israel was the first to call attention to the presence of fever in tumors of the kidney.

Urinary symptoms, such as pain, frequency, and burning, are hardly ever present.

Physical Examination.—Palpation of the kidney nearly always shows some change in the kidney the site of the tumor. In cases in which the tumor is very large there is no difficulty in palpating the tumor. One can usually outline the presence of a tumor in the kidney region. If the involvement is not too extensive, the mass may be movable; very often, however, the mass is fixed. In cases in which the mass is fixed, the outlook for doing a complete removal, of course, is not very good; in other words, when the diagnosis is easy from the standpoint of palpation the patient's chances for a long life after his operation are not so good, except, of course, in very thin patients in whom palpation is very much simpler and very much easier than in the thick-bellied person who is short-coupled. While palpation gives us definite symptoms in a certain percentage of the cases, it cannot be relied upon alone to make the final diagnosis in all cases. There are cases in which the tumor is small, the belly so thick, and the kidney in such a high position that palpation becomes a difficult procedure. One must then call to his aid additional methods of diagnosis to verify one's suspicions, and I believe that one is justified in stating that the one single agent that gives us more information than any other regarding the presence or absence of tumor is a pyelogram. I do not believe that pyelography is a procedure to be lightly and recklessly employed *ad libitum*. I think if one is going to use pyelography for diagnosis, one should have pretty definitely in view the object that he wishes to attain. Just to do a pyelogram to be doing something does not seem to me to be applying to the proper use this very valuable aid. I do believe that in some of these cases of obscure kidney hemorrhage in which one cannot come to any definite conclusion, pyelography is an agent which gives us very valuable and very definite information. I believe at this point it would be a good plan to show you several pyelograms we have made in the past of kidney tumors to demonstrate the findings.

Differential Diagnosis.—As previously mentioned, every patient who has hematuria should be handled from the standpoint of determining the origin of the bleeding and its cause. In cases of hypernephroma the lower urinary tract can be very readily excluded as being the cause of the bleeding by means of cystoscopic examination, so that in the differential diagnosis excluding lesions of the lower urinary tract is simple enough. However, the fact that patients who have malignant disease of the kidney may also have pathology in the lower urinary tract must not be forgotten, for occasionally one sees a patient suffering with enlargement of the prostate gland who also has a hypernephroma. Our chief concern, however, in the differential diagnosis is with other lesions of the kidney that produce symptoms that may be produced by hypernephroma, including lesions of other viscera.

As a rule a stone that produces profuse hematuria can be demonstrated by means of the *x*-ray, provided the *x*-ray technic is good and the plates are carefully read. However, we know that all cases of stone in the kidney cannot be demonstrated roentgenologically. The possibility of the presence of stone associated with hypernephroma must not be lost sight of. A patient may have both conditions in his kidney, or if the *x*-ray is positive one might diagnose the nephrolithiasis and miss the hypernephroma.

Renal tuberculosis would scarcely be confused with hypernephroma, as the average case of kidney tuberculosis that consults the urologist is an advanced one in which the patient has bladder involvement, and cystoscopically one sees evidences of bladder tuberculosis. This coupled with pus in the urine should lead us to suspect a lesion other than a malignant tumor, as renal tuberculosis is more constantly associated with pyuria than a malignant tumor, although the fact that pus is present in the urine does not of itself necessarily exclude a malignant tumor. In doubtful cases a diligent search for tubercle bacilli in guinea-pig inoculations establishes the diagnosis of tuberculosis.

Polycystic disease involves both kidneys, which are enlarged, irregular, nodular, and easily movable. Enlargement of the kidney on each side with irregular surface would lead us to suspect polycystic disease rather than malignant disease of the kidney. Malignant tumors primary in both kidneys are very rare, and metastases with enlargement of the second kidney likewise are so rare as to hardly enter into the differential diagnosis.

Nephritis may at times offer problems of differentiation, but should not be very difficult of solution. A group of cases that are relatively infrequent, and yet one sees them from time to time, and call for differentiation are the cases of so-called pyelitis follicularis or bleeding pyelitis. These cases, as a rule, might be excluded by means of a pyelogram.

There are many other causes of kidney hemorrhage. They are rather uncommon, and it is in these uncommon and rare cases in which the findings are atypical, it seems to me, that one is justified in performing pyelography. I do not believe that if the patient has all the typical text-book signs of kidney tumor it is necessary to perform pyelography, which, as you know, is not entirely free from danger.

Lesions of other abdominal viscera may occasionally call for differentiation in the group of cases in which there is no history of hematuria and in which diligent search for blood is negative. The lesions most frequently met with are those of the gall-bladder, stomach, and duodenum. On the left side occasionally one is called upon to differentiate between tumor of the kidney and a lesion of the spleen. In these two groups of cases pyelograms may be a very definite aid in the differential diagnosis.

Treatment.—The treatment of hypernephroma is, of course, surgical. Surgical treatment calls for a complete nephrectomy, which is possible in a large number of instances. Before the kidney is removed, however, it has always been my plan to explore as well as possible for the presence of an extension of the tumor outside of the kidney, and the presence of metastases in fatty capsule and in the regional lymph-glands. To determine whether or not the tumor has invaded the renal vein is difficult and cannot always be done. I remember well in one instance, after the clamps were applied and the kidney removed, the renal vein showed the presence of very large tumor metastases.

CLINIC OF DR. DANIEL N. EISENDRATH

Cook County Hospital

THE LYMPHATICS OF THE FEMALE BREAST IN RELATION TO CARCINOMA OF THE BREAST

Summary: Presentation of 3 cases of carcinoma of the breast. Necessity of a thorough familiarity with the different routes along which carcinoma spreads from the breast proper to the regional lymph-nodes which drain its parenchyma. Under what conditions is an exploration with removal of all lymph-node bearing fat of the sub- and supraclavicular regions justifiable? Five types of lymphatic drainage described by Mornard.

I desire to present today 3 cases of carcinoma of the breast. Two of these were operated upon four years ago and the third one at our last clinic, a week ago.

My chief reason for showing these patients is to emphasize the necessity of a thorough familiarity with the different routes along which carcinoma spreads from the breast proper to the regional lymph-nodes which drain its parenchyma. Of special importance is the tendency for cancer in the upper half of the breast to extend by way of certain lymph trunks to the sub- and supraclavicular lymph-nodes.

The first patient was operated by me at the Michael Reese Hospital on April 27, 1916, that is, nearly four and a half years ago. At that time she was only twenty-seven years of age. The onset of her symptoms was very sudden, in the form of a sharp pain in the right breast, only three weeks before admission. There was no history of any injury or of any inflammatory disturbance. She was unmarried and there was no history of malignancy in her family. I found three very hard nodules in the upper inner quadrant of the right breast. These masses were quite circumscribed and freely movable, but not tender. There were no palpable axillary or supraclavicular lymph-nodes. I considered the condition a benign one before operation, but a frozen section was made after excision of one of the nodules. The pathologist reported finding a typical carcinoma, and consequently a radical removal of the breast was done. On account of the development of the primary focus in one of the upper quadrants I felt that we were justified in making an exploratory incision above the clavicle. I had just finished reading the study of the lymphatic drainage of the breast by Mornard, to which I will refer in detail later, and was very much impressed with the frequency of occurrence of secondary involvement of the sub- and supraclavicular lymph-nodes in primary carcinoma of the upper quadrants of the breast. I removed the fat of the supraclavicular region and was rewarded by finding two lymph-nodes, each the size of a pea, both of which revealed microscopically typical carcinomatous changes. These nodes were not palpable before operation. Further microscopic study of the removed breast tissue showed that the changes which were referred to by pathologists as characteristic of chronic cystic mastitis were present in a number of places, and from these areas had developed the carcinomatous nodules in the inner upper quadrant.

I was unable to trace the patient after her discharge from the Michael Reese Hospital, and was greatly surprised when she was admitted to my service in this hospital a few weeks ago (four and a half years after my operation) suffering from widespread intrathoracic metastases, but without any evidence of recurrence at the site of the radical breast amputation nor in the supraclavicular region of the operated side.

We will not stop to discuss the question of supraclavicular involvement, but will take it up later in connection with the third case and Mornard's studies.

The second patient is fifty years of age and was operated by me in June, 1916—four years ago. She had first noticed a mass in the left breast six months before. The tumor was hard, nodular, and located in the upper outer quadrant. The nipple was retracted and there were adhesions of the skin over the tumor. No enlarged axillary or supraclavicular lymph-nodes could be felt. A radical operation was done and further examination of the removed breast confirmed the diagnosis of carcinoma. The supraclavicular region was not explored at this first operation, but about six weeks later a small, hard lymph-node could be felt above the clavicle, and the patient was advised to have a thorough removal made of all of the supraclavicular fat and this palpable node. This was done, and the node showed the presence of carcinoma. She was given a series of intensive x-ray treatments over both the site of removal of the breast and over the supraclavicular region. Until February, 1920 (three and a half years after operation) examination at frequent intervals failed to reveal any evidence of a local recurrence, but she has developed symptoms recently referable to the spine, and the presence of a metastasis in the body of the fifth lumbar vertebra was confirmed by radiographic examination.

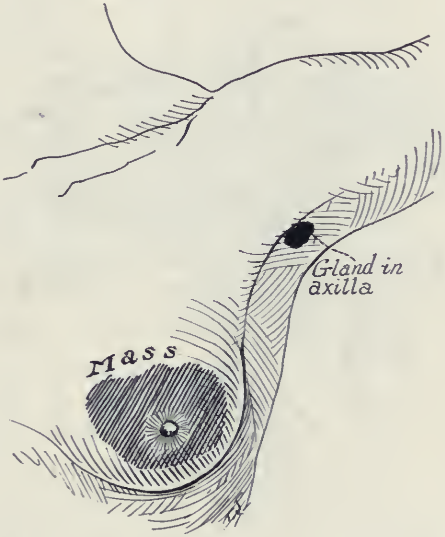

Fig. 417.—Location of carcinoma involving predominantly the upper half of the breast. Note the large axillary glands.

Here again we have no evidence of a spread to the supraclavicular region at the time of the first operation, but examination six weeks later showed a lymph-node which no doubt was too small to be felt before the radical amputation of the breast.

The third patient is fifty years of age and noticed a mass in the left breast about one year ago. We find a typical hard, nodular mass (Fig. 417) beneath the nipple. All four quadrants of the breast are involved, but the upper two predominantly (Fig. 417). There is a single hard axillary lymph-node about the size of a walnut, quite fixed on the chest wall. Palpation of the supraclavicular region fails to reveal any enlarged lymph-nodes.

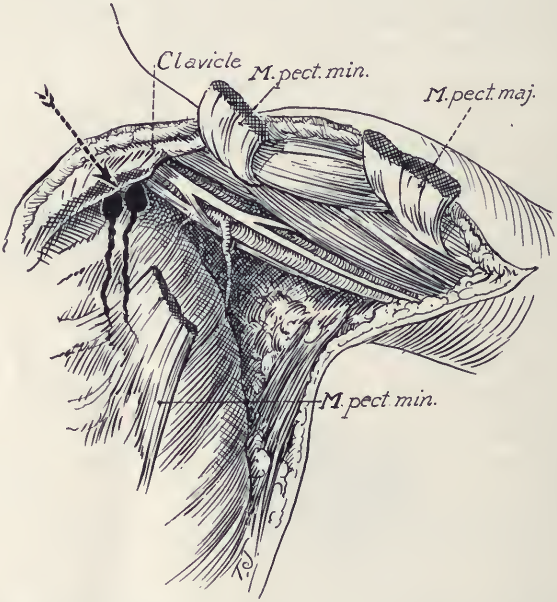

Fig. 418.—Appearance of chest wall after division of pectoralis major and minor and removal of all axillary fat and lymph-nodes. The arrow points to the two subclavicular lymph-nodes, which presented on section typical carcinomatous changes. Leading to each one of these was a lymphatic trunk also showing typical carcinomatous involvement.

The opposite breast and the corresponding axillary and supraclavicular regions were negative on examination.

A radical operation was done one week ago, and we found extensive involvement not only of the lymph-nodes adjacent to the axillary vein but also of those lying on the subscapularis muscle, the removal of which latter lymph-nodes has been so strongly emphasized by the late Dr. W. L. Rodman.

The most interesting finding, however, was the presence of two carcinomatous lymphatic vessels (Fig. 418) lying between the pectoralis major and minor muscles. The firm cords ended in lymph-nodes lying just beneath the clavicle and evidently connecting with others in the supraclavicular region, not accessible to palpation. I did not feel justified in a thorough removal of the lymph-node bearing fat of the supraclavicular region because I deemed the case one which was not favorable to a radical cure owing to the wide-spread dissemination which the operation on the breast proper had already disclosed.

These 3 cases bring up the question of how frequently does primary involvement of the sub- and supraclavicular lymph-nodes occur in carcinoma of the breast, and what change, if any, is necessary in our radical operation in order to conquer this regional invasion. In other words, should we also add a thorough removal of the supraclavicular lymph-node bearing fat when there are no palpable enlargements in this space? On one point I believe we are nearly all of the same opinion, and that is, if there are palpable supraclavicular lymph-nodes not only is the prognosis very grave, but radical operation is nearly always contraindicated.

The chief question to discuss then is, Under what conditions is an exploration with removal of all lymph-node bearing fat of the sub- and supraclavicular regions justifiable?

Let me first direct your attention to the most important features of Mornard's[1] investigations on the relation of the lymphatics of the breast. He injected both sides in 50 subjects by the Gerota method and found five types of lymphatic drainage toward the axillary, sub-, and supraclavicular nodes. These are the following:

Type 1 (Fig. 419). This is the classical mode of drainage, which, however, Mornard only found twelve times on both sides in 50 subjects and forty-five times in 100 breasts, that is, only 25 per cent. of individuals show the anatomic conditions which we have been taught as being present in every female breast. In this classical type 3 to 5 lymphatic trunks leave the

[1] Revue de Chirurgie, vol. 35, 1916.

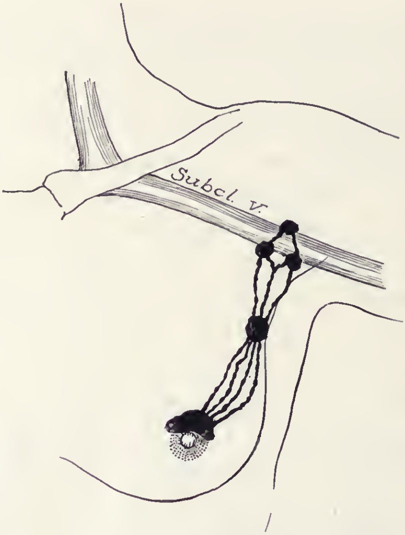

Fig. 419.—Three to five lymphatic trunks leave the outer and lower border of the mammary gland and reach the central group of lymph-nodes lying on the axillary vein. The first set of relay nodes are shown lying along the outer border of the pectoralis major muscle (after Mornard).

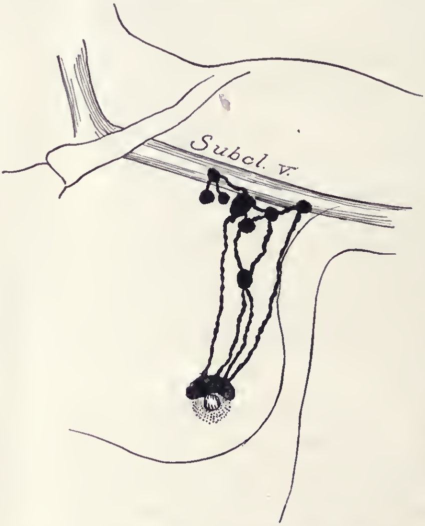

Fig. 420.—(Type 2). Lymphatic trunks leading to the humeral chain (outer axillary). In this illustration Mornard shows how the lymphatics from the outer half of the breast lead not only to the center but to the outer axillary lymph-nodes (after Mornard).

outer and lower border of the mammary gland and reach the central group of lymph-nodes lying on the axillary vein (Fig. 419). The first set of relay nodes are those lying along the outer (lower) border of the pectoralis major muscle (Fig. 419). When his injections passed beyond these pectoral and axillary nodes the fluid reached the subclavicular or even the supraclavicular nodes, but the injection rarely reached these latter groups by this route.

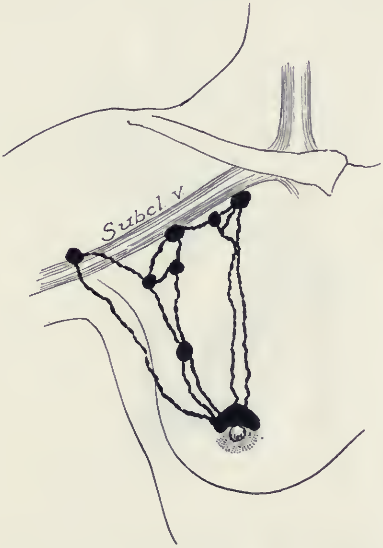

Fig. 421.—(Type 3). Two lymphatic trunks (axillary and subclavicular). One of these proceeds directly to the central axillary group of lymph-nodes, with an occasional relay node along the lower border of the pectoralis major muscle, while the other trunk proceeds directly to the group of nodes lying beneath the clavicle (after Mornard).

Type 2 (Fig. 420). Lymphatic trunks leading to the humeral chain (outer axillary). In 12 of 100 breasts an efferent trunk left the lower outer border of the breast and followed the lower border of the pectoralis major muscle to empty into a lymph-node lying on the axillary vein. This arrangement coexists especially with some of the other types to be described later.

Type 3 (Fig. 421). Two lymphatic trunks (axillary and subclavicular). In a large number, that is, 27 of 50 subjects on both sides (a little over 50 per cent.) and 35 of 100 breasts, Mornard observed two trunks. One of these is the classical one described as Type 1 (Fig. 419), which leaves the outer lower portion of the breast and leads to the central axillary group of nodes with an occasional relay node lying along the lower border of the pectoralis major muscle. The other lymphatic trunk is formed by two or three smaller ones which leave the upper and especially the upper inner portion of the breast. These trunks (Fig. 421) proceed directly to the group of nodes (subclavicular) lying beneath the clavicle and pass upward beneath the pectoralis minor near its costal insertions. When this type is present a single barrier formed by the subclavicular nodes (Fig. 421) separates the breast from the supraclavicular lymph-nodes. In 20 cases Mornard found a complete independence of the two territories, axillary on the one hand and subclavicular on the other (Fig. 422). This frequent arrangement (35 in 100 breasts) seems to explain the rapidity of invasion of the subclavicular

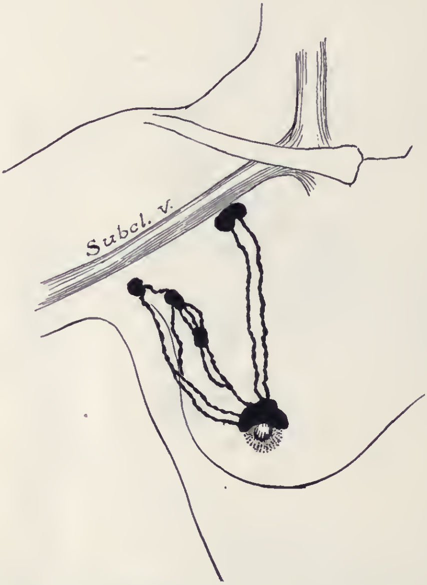

Fig. 422.—Complete independence of the two lymphatic trunks leading to the axillary and subclavicular lymph-nodes respectively (after Mornard).

nodes so often found in cancers of the upper inner portion of the breast.

Type 4. Lymphatic trunks between the two pectorals. This closely resembles the third type, but the trunk to the subclavicular nodes passes between the pectoralis major and minor muscles. This is the trunk which I was able to demonstrate at operation in our third case (Fig. 418) of today's clinic.

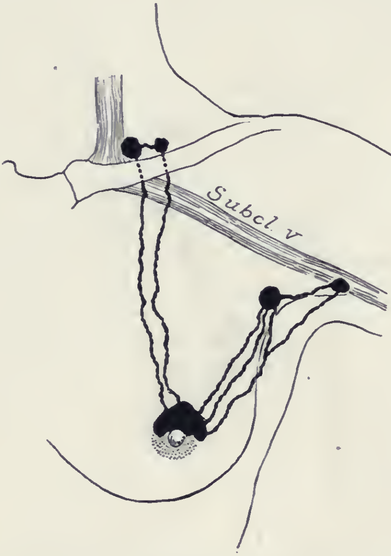

Fig. 423.—Lymphatic trunks leading separately to the axillary and subclavicular spaces and lymph-nodes (see text). This direct route to the subclavicular region explains how an early invasion of this region may occur, especially in cancers of the upper inner quadrant (after Mornard).

Type 5 (Fig. 423). Lymphatic trunks direct to the supraclavicular nodes. Mornard only found this in 3 of 100 breasts, but it is of great clinical importance. A lymphatic trunk leaves the upper inner portion of the breast and ascends (either between the two pectoral muscles or beneath the minor) to the clavicle (Fig. 423), passing between the subclavian artery and vein to the supraclavicular nodes. This route explains how the axillary nodes may, as in our first case, be omitted and an early invasion of the supraclavicular nodes occur, especially in cancers of the upper inner quadrant.

The topography of the supraclavicular lymph-nodes is of great importance in connection with the question of whether or not a removal of the lymph-node bearing fat of this region shall be done in cancers of the upper half of the breast. The nodes occupy (Fig. 424) the triangle between the internal jugular and subclavian veins and omohyoid muscle. Mornard found two sets of nodes, (*a*) an internal and (*b*) an external. In some cases these are combined. The internal group consists of one or more nodes lying in the angle (Fig. 424) between the internal jugular and subclavian veins, beneath the outer border of the sternomastoid muscle. These are the seat of election for recurrences in the supraclavicular group.

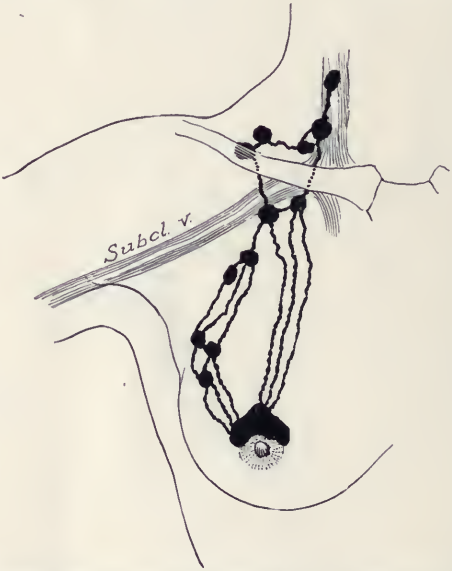

Fig. 424.—Topography of lymph-nodes of the sub- and supraclavicular region, showing how carcinoma travels from the breast to the sub- and supraclavicular regions directly without much involvement of the axillary lymph-nodes. In the supraclavicular region are seen two sets of nodes described by Mornard, namely, the internal and external (after Mornard).

The external group is less often met with. They are found in the lower outer angle of the triangle formed by the subclavian and internal jugular veins and the omohyoid muscle (Fig. 424). In general, there are two to three nodes of which the most external can reach the trapezius muscle. When both internal and external groups coexist each drains into its own territory. The nodes of the two groups can be united by lymphatic trunks, but more often they remain separate.

My reasons for quoting these investigations of Mornard are, first, that they explain many of the cases in which the first evidence of a recurrence is in the supraclavicular nodes; and second, that the question arises as to whether or not we should add a thorough removal of the lymph-node bearing fat of the supraclavicular region to our radical operation as it is performed by the majority of surgeons at the present time. I am not yet convinced of the necessity of this as a routine procedure. Of one thing I am certain, however, and that is, in cancers of the upper half of the breast, as in our 3 cases (especially in those of the upper inner quadrant), we should remove all of the fat and other tissues as far up as the clavicle, and if possible to the subclavian vein itself.

A CASE OF UMBILICAL FISTULA

Summary: History of purulent discharge from umbilicus for one month before admission to hospital. Abdominal findings at operation confirmed working diagnosis of tuberculous peritonitis as cause of the umbilical fistula. Discussion of various possible sources of such a condition.

You will probably recall a case of tuberculosis of a hernial sac which I presented at a recent clinic,[1] and the discussion of the multiform pictures under which the various forms of abdominal tuberculosis masquerade.

Our first patient today is another example of the protean manner of occurrence of this form of infection. A fairly well-developed young woman of twenty-two entered the hospital a week ago complaining of a purulent discharge from the umbilicus. She felt perfectly well until six months ago, when pain was experienced on both sides of the abdomen, which gradually decreased in severity during the next four months. About three months ago she noticed a swelling over her umbilicus, which became quite painful about a month ago. The umbilical protrusion increased gradually until ten days before admission to this hospital, when the discharge of a pint of pus occurred spontaneously from the umbilicus. This discharge has continued to the present time. Her family and personal history fail to give us any data as to a possible cause for the umbilical suppuration. Aside from slight discomfort from some abdominal distention during the past three months, there have been no symptoms referable to the alimentary canal. She has lost about 25 pounds during the past seven months and has had night-sweats for two months. There is no history of pelvic trouble, or chills, jaundice, or of urinary disturbances.

Since entrance about one week ago her temperature has ranged from 99° F. in the morning to 101° F. at night. There is a slight leukocytosis and the examination of the urine reveals nothing abnormal.

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[1] Surgical Clinics of Chicago, 4, 569, June, 1920.

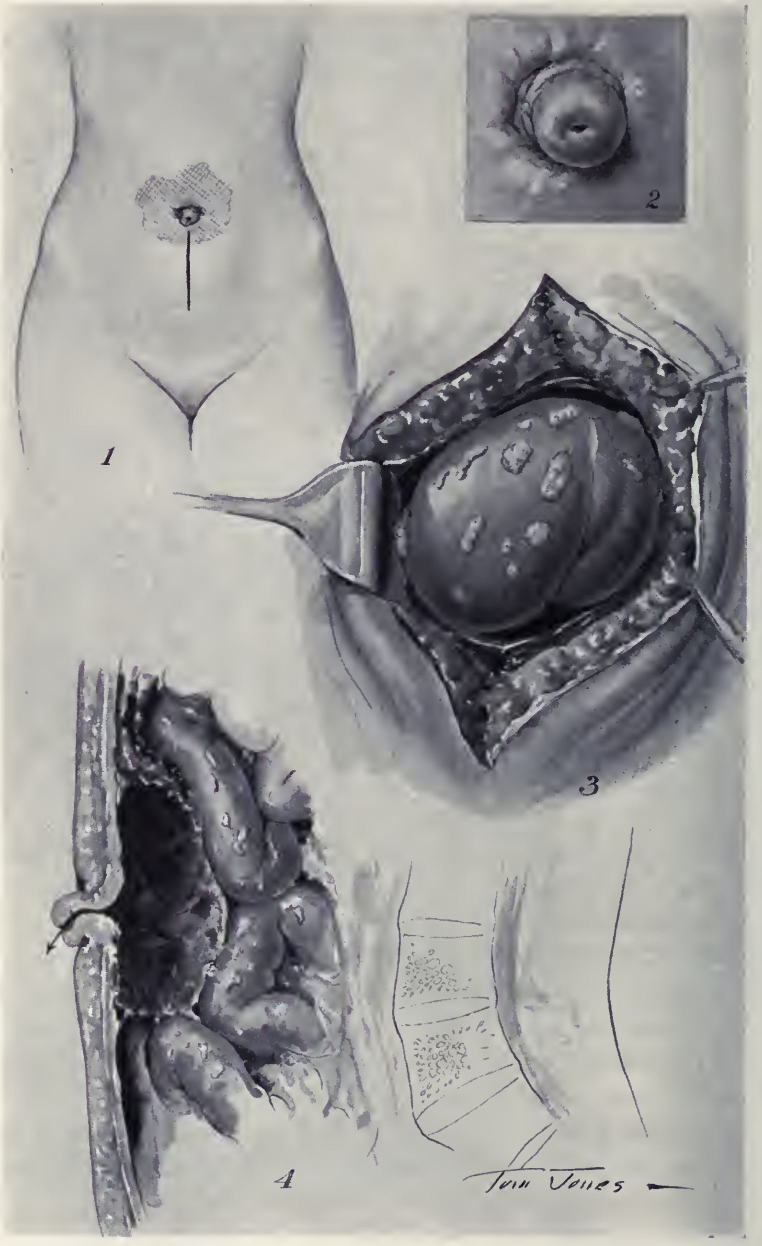

Fig. 425.

Let us first inspect the abdomen. Corresponding to the normal location of the umbilicus is an opening whose edges are everted and lined with pale, flabby granulations. Note the thick pus which escapes from this opening. The abdomen is moderately distended and seems especially prominent just above the region where the umbilicus would be located in a normal individual.

On palpation there is a distinct resistance corresponding to the supra-umbilical prominence. This tumor is nodulated, firm, about the size of the palm of the adult hand, and located just beneath the abdominal wall, that is, within the peritoneal cavity.

In the clinic on abdominal tumors[1] I called attention to an important differential point between tumors located in the abdominal wall itself and those lying beneath it, namely, that in the former the tumor becomes more prominent when the patient is asked to sit up, while if the tumor is intraperitoneal it becomes less prominent and cannot be felt when the patient sits up. This test shows that the tumor in our present case, although attached to the abdominal wall, is evidently an intra-abdominal one. Percussion fails to reveal any free fluid, the only area of dulness being that over the supra-umbilical tumor. Bimanual vaginal as well as rectal examination do not reveal any abnormal condition.

I am of the opinion that we are dealing with an umbilical fistula due to the spontaneous rupture of an intraperitoneal abscess of tuberculous origin. This working diagnosis is based on the history of diffuse abdominal pain and loss of weight during the past six months, and especially by our finding the nodulated intraperitoneal mass adherent to the abdominal wall just above the discharing umbilicus.

Fig. 425.—1, Shaded area represents the extent of the palpable mass. In the center of the shaded area is the umbilical fistula. The black line below the fistula represents incision made to explore abdominal cavity. 2, Detailed drawing of appearance of umbilical fistula. 3, Nodular tubercles on coil of intestine presenting through incision. 4, Sagittal view of abdominal wall showing relation of mass of caseated tubercles to the umbilical fistula.

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[1] Surgical Clinics of Chicago, vol. iii, No. 4, p. 915, August, 1919.

The patient having been anesthetized, I will make an incision in the median line just below the umbilicus. Observe the marked thickening of the parietal peritoneum as a first indication of some chronic inflammatory process within the abdomen. This is very typical of the dry forms of tuberculous peritonitis.

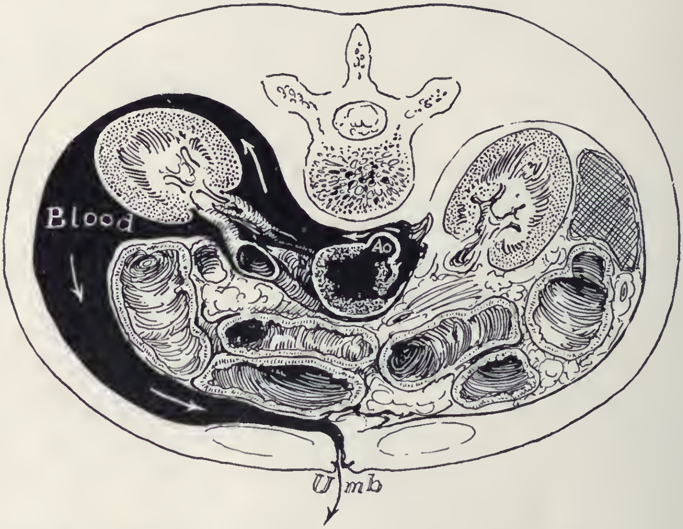

Fig. 426.—Diagrammatic representation of how blood may escape from retroperitoneal tissues to umbilicus (after Cullen).

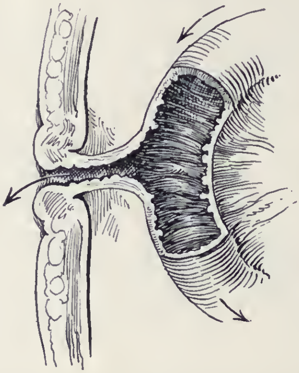

Fig. 427.—Patent Meckel's diverticulum opening at umbilicus. Arrows indicate direction of fecal current.

Note the large yellow nodule which protrudes from one of the edges of the peritoneal incision. The nature of this nodule is at once confirmed by our finding a large number of similar nodules on the exposed visceral and parietal peritoneum. Some of the nodules are grayish, while others are yellow, that is, caseous. The size of the individual nodules averages about that of a hemp seed. We are evidently dealing with a much more virulent form of peritoneal tuberculosis than that usually referred to as the miliary form. This case belongs to the type which I have previously referred to as the nodular or caseous. There is but little free fluid. A probe inserted through the umbilical fistula is felt (when I insert my hand through our opening in the peritoneum) to pass directly into a mass which I inter-

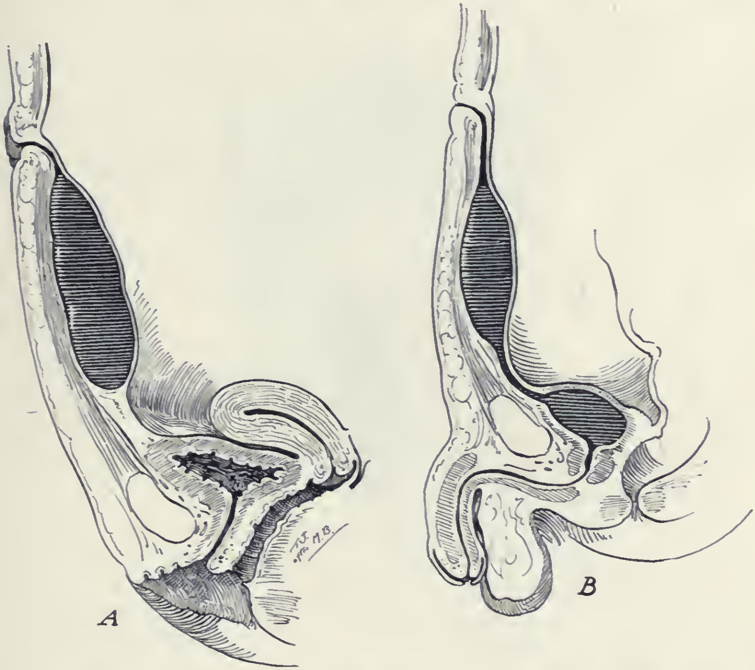

Fig. 428.—*A*, Diagrammatic representation of fistula due to persistent urachus opening at umbilicus (after Cullen). *B*, Diagrammatic representation of persistent urachus opening above the umbilicus and communicating with the fundus of the bladder (after Cullen).

pret as being composed of agglutinated tubercles which have become adherent to the abdominal wall in the vicinity of the umbilicus. The caseation of these conglomerate tuberculous masses was undoubtedly the cause of the discharge of pus from the umbilicus a month ago and will continue until the underlying infection subsides.

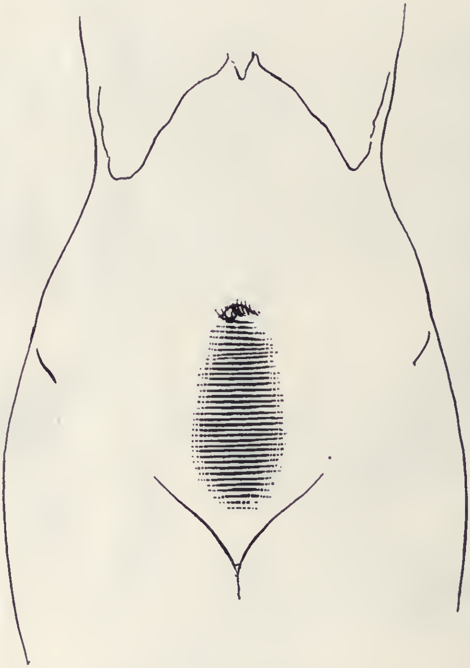

Fig. 429.—Shaded area represents location of pain and induration in cases of inflamed persistent urachus.

The mass is not the result of a tuberculosis of the mesenteric lymph-nodes nor of a rolled-up omentum as is so often encountered in the form of tuberculosis of the peritoneum.

After closing our median line incision we will enlarge the opening through which the pus has been discharging from the umbilicus in order to provide for better drainage of the caseated tubercles. Within a few days a systematic course of *x*-ray treatments will be begun. Of all the therapeutic measures for peritoneal tuberculosis this has been found to give the most satisfactory results. The entire surface of the abdominal skin will be divided into a series of squares in order to expose as large a number of areas as possible during the course of these deep *x*-ray treatments. The prognosis in this nodular or caseous type is, in general, less favorable than in the ordinary dry or in the ascitic forms, and it will no doubt require a longer time to see a favorable result in this patient. Just as is the case elsewhere in the body, we note a difference in the virulence of organisms in abdominal tuberculosis. The formation of large nodules and caseating masses such as we found at operation today indicates a high degree of virulency and a correspondingly graver prognosis.

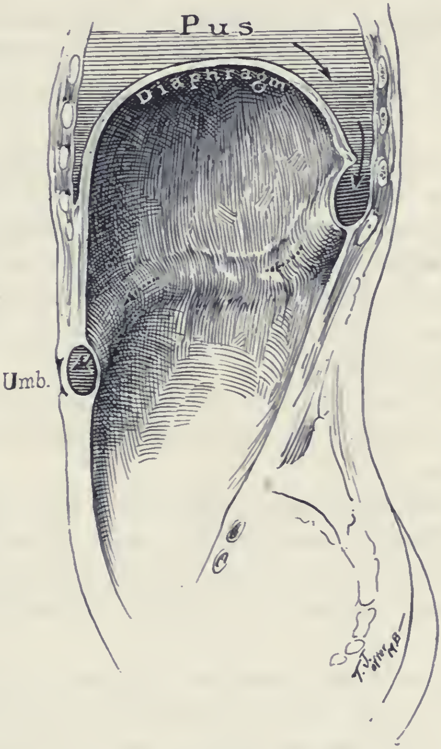

Fig. 430.—Umbilical abscess communicating with pleural cavity (modified from Cullen).

A purulent discharge from the umbilicus may be due to a number of causes other than a tuberculosis of the peritoneum. We are indebted to Dr. Thomas S. Cullen for a most valuable contribution[1] on the diseases of the umbilicus, and I can warmly recommend his recent book to those of you who are not familiar with a chapter in surgery which has not received as much attention as it deserves.

Fluid, whether it be pus, blood, or urine escaping from the umbilicus, may have its origin from (1) the retroperitoneal tissues, (2) from the peritoneal cavity, and (3) from a patent urachus.

1. *Escape of Retroperitoneal Fluid from the Umbilicus.*—Cullen states that blood or pus in the retroperitoneal tissues may by a process of dissection loosen up the peritoneum from the underlying muscular or adipose tissue until the umbilicus is reached, and the blood or pus either cause a protrusion at the location or perforate the skin of the umbilical region and be spontaneously discharged.

Cases have been reported where (1) a periprostatic abscess, (2) an empyema, and (3) a broad ligament abscess have opened at the umbilicus.

2. *Intraperitoneal Causes.*—Cases have been reported under this heading where (1) an appendix abscess, (2) an abscess of the liver, (3) a pneumococcus intraperitoneal collection of pus, and (4) a tuberculous peritonitis have been discharged through the umbilicus.

Other intraperitoneal causes for a discharging umbilicus are: (1) a patent Meckel's diverticulum, (2) a fecal fistula due to perforation of an adherent coil of small or large intestine.

3. *Escape of Urine or Pus from a Patent Urachus.*—The urachus may remain open in postfetal life, all the way from the bladder to the umbilicus, so that urine escapes from the latter. If the urachus ceases to communicate with the bladder, a blind sac persists which discharges its contents at intervals through the umbilicus. If infection occurs the fluid becomes purulent, and the local findings are quite similar to

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[1] Diseases of the Umbilicus and Urachus, W. B. Saunders Co., 1916.

those presented by our patient today. The principal symptoms in cases of infected urachal remains or of urachal cysts are pain and induration in the median line of the abdomen from the umbilicus associated with generalized symptoms, such as fever, chills, etc. There are, as a rule, no bladder symptoms.

Of all of the possible sources of pus discharging from the umbilicus, as in our case, we are particularly interested in the tuberculous peritonitis. In children such a complication is not infrequent.

Cullen, from his study of all reported cases of this kind, believes that the fluid reaches the surface by two methods—either by gradual disintegration of the abdominal wall or by distention of the umbilical opening. A local cause such as we found today, namely, that the discharge is due to the caseation of large tuberculous masses attached to the parietal peritoneum in the vicinity of the umbilicus, is not mentioned by Cullen.

CLINIC OF DR. CARL B. DAVIS

Presbyterian Hospital

TUMORS OF THE LARGE BOWEL. PRESENTATION OF A GROUP OF CASES ILLUSTRATING TYPICAL AND ATYPICAL PATHOLOGY IN TUMORS OF THE LARGE BOWEL

1. Hirschsprung's Disease in a Child of Six Months; Findings at Operation; Mortality Exceedingly High in the First Year of Life.

2. Chronic Sigmoiditis in a Patient with a Left Inguinal Hernia.

3. Diverticulitis of the Sigmoid Frequently Mistaken for Carcinoma; Microscopic Examination of Removed Specimen Necessary to Establish Diagnosis.

4. Peritoneal Tuberculosis in a Patient Operated on Four Years Previously for Appendicitis, with Resultant Fecal Fistula. Excellent Result Obtained by Operation, *x*-Ray Treatment, and Exposure to Sun's Rays.

5. Stricture of the Rectum the Result of a Vaginal Gonorrheal Infection Invading the Rectum. Operative Treatment—Resection and Establishment of a Colostomy. Superiority of Abdominal Over Sacral Anus.

6. Adenocarcinoma in a Girl of Nineteeen with Extensive Gland Involvement. Patient in Good Health Three Years After Operation.

Rather than cover the entire subject of large bowel tumors, an attempt will be made to summarize a number of interesting cases. The records were chosen because they present both typical and atypical examples of pathology in their groups. Hirschsprung's disease, or megacolon, a dilatation of the colon, rather than an actual new growth, might be included, as the appearance of the patient is quite suggestive of an abdominal tumor.

A true Hirschsprung's disease is found in the large gut. Analogous dilatations of the ileum do not rightly belong here. The disease involves at times the entire colon. More frequently it occurs in the sigmoid or sigmoid and descending colon. There is usually an enormous hypertrophy of the musculature of the dilated bowel. In one case, however, we found a thinned-out intestinal wall, not so heavy as a normal colon. This patient was operated on at about six months of age. During the first month of life he was thought to be constipated merely and the movements were obtained by enemata. At about three months of age he showed an enormous dilatation of the abdomen; so much so that it was feared he would rupture an intestine before relief could be obtained by flushing. Early relief was given by simple rectal enema, later repeated flushing of the colon was required, and finally it required hours of effort on the part of the physician and nurse to reduce the enormous distention caused by feces and gas (Fig. 431). The gas in this case was the predominating feature. The distention would commence and be complete in six hours. The parents brought the child for operation willingly and eagerly, as the last two attacks almost resulted in death. On both occasions the baby was exhausted for a number of days. x-Ray examination at this time showed a considerable quantity of gas in the colon (Fig. 432).

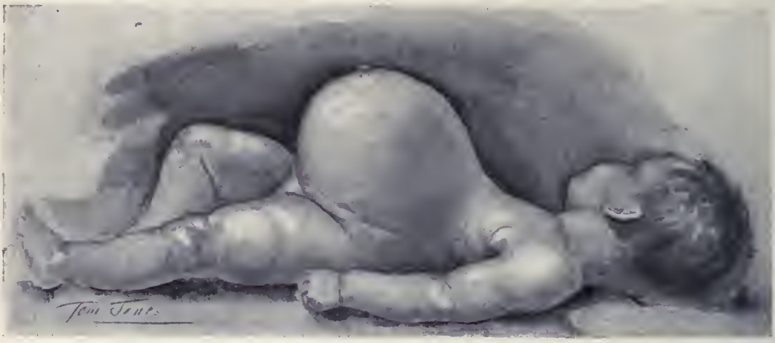

Fig. 431.—Sketch of the baby with megacolon.

At operation a dilated sigmoid and descending colon were found. The enlargement did not present as a spindle-shaped affair, but showed a very rapid transition from normal gut to the diseased portion. The length of the involved intestine was about 8 inches. The baby was very weak, so no effort at primary resection was made. A second incision was made in the left side and the diseased loop, with 1 or 2 inches of normal gut, was drawn out and fixed in position. After forty-eight hours the loop was resected and a clamp applied to the spur composed of the walls of the adjacent loops of bowel. With the destruction of the spur it was thought that the fecal current would be restored to its normal channel, and the case would be closed in the usual manner. As the abdominal wall closed down on the

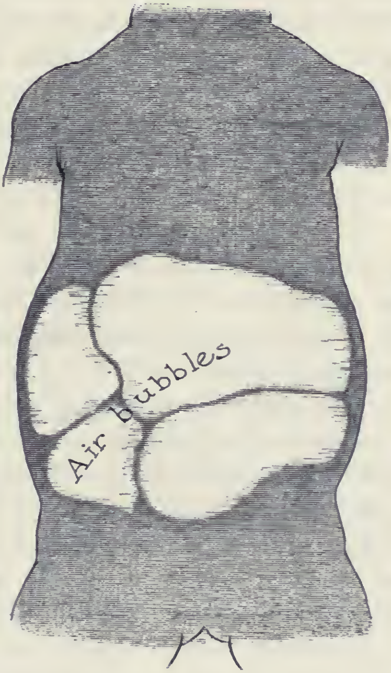

Fig. 432.—*x*-Ray photograph of a baby with megacolon. The plate was made while attack was subsiding. Colon at that time contained a considerable quantity of air.

fistula fecal matter passed by rectum. This normal condition gradually gave way to signs of obstruction. The colostomy was opened under the impression that the spur had not been cut down sufficiently. We did not use a barium enema for diagnosis, as we had had considerable difficulty in getting rid of the enema injected in a previous and somewhat similar case. The spur was found obliterated to what appeared a sufficient degree. Nevertheless, the clamp was applied again to give plenty of space at the site of resection. The colostomy gradually closed again with the same grade of obstruction as before. A lateral anastomosis was then made between the cecum and distal portion of the sigmoid. The child did well at the hospital and was apparently in normal health for a month after returning home. There was a sudden cessation of bowel movements, and at the end of forty-eight hours the colostomy was opened again with the escape of a large amount of feces and gas. A proctoscopic examination of the anastomosis was made and showed an opening large enough to readily admit the proctoscope. Examination of the anastomosis was also made from the colostomy opening. There seemed to be a normal caliber of the gut throughout. Barium was then injected from the colostomy in a downward direction filling the gut to the anal opening. x-Ray examination showed a cylindric shadow normal in all respects. This mass of barium was not expelled by the infant. It was necessary to remove it by flushing and digital exploration. For the last five years the bowel has functioned through the colostomy opening. Now that the child is old enough to co-operate, a further effort at diagnosis is to be made. At present there is no dilatation of either the ascending or transverse colon, either ascending or transverse. There was no hypertrophy of the wall of the excised section, but rather a thinning out. There was no dilatation in the rectosigmoidal region as might be expected if there were a failure of the musculature in the rectum. The failure of the rectum to expel the barium might be due to the lack of continuity with the sigmoid. This same condition was seen in a man who had a colostomy with resection of the rectosigmoidal region for carcinoma, leaving the ampulla of the rectum. Mucus would accumulate in this section, producing distress, until he learned to flush this segment at regular intervals.

Another child, with the same history of distending abdomen and persistent constipation, was found with a sigmoid colon as large as an adult stomach, and with musculature as heavy as sole leather. A comfortable margin for anastomosis was left in the rectosigmoidal region and the distended gut resected. When anastomosis was attempted it was found that the distal stump had contracted beneath the level of the peritoneum. The stump was grasped in forceps and pulled out and an anastomosis made. The union appeared satisfactory and the abdomen closed. The child died within a week. The distal end of the gut had retracted below the culdesac into the pelvic diaphragm and had opened up most of the line of suture.

In this case the longitudinal and circular fibers were greatly overdeveloped, and when cut loose from the upper gut simply pulled down into the sling of the levator ani muscles.

The high mortality (80 per cent.) in the first year and a gradually lessening percentage up to five years of age results in very few of these individuals reaching adult life.

A young man, twenty-eight years old, with an abdomen about the diameter of a flour barrel, gave a typical history. He stated that all his life he had had a constipation that could be relieved only by flushing. Cathartics had no effect on him. About once a week he took a number of hours to empty his colon. Each movement consisted of several quarts of material.

After a flushing he was given a barium enema under the fluoroscope. So much material was taken into the bowel and so enormous a shadow was shown that it was feared the patient might be injured. A shadow 10 inches in diameter was obtained (Fig. 433). The man was in poor condition. The legs and arms were thin and he gave the impression of an enormous abdomen having attached to it head, arms, and legs. He reported primarily for an arthritis of the hip. He was not desirous of having the abdomen opened, and no great effort on our part was made to cause the patient to change his mind.

The following history is an interesting example of mistaken diagnosis. Miss F., age forty, had been disturbed by a left inguinal hernia for a number of years. The last two years previous to operation the hernia would appear in spite of her efforts to control it by a truss. During the last six months before operation the hernia had been fixed in the groin. She was unable to reduce it. The tumor was becoming more troublesome because of her efforts in her profession, which was that of a masseuse.

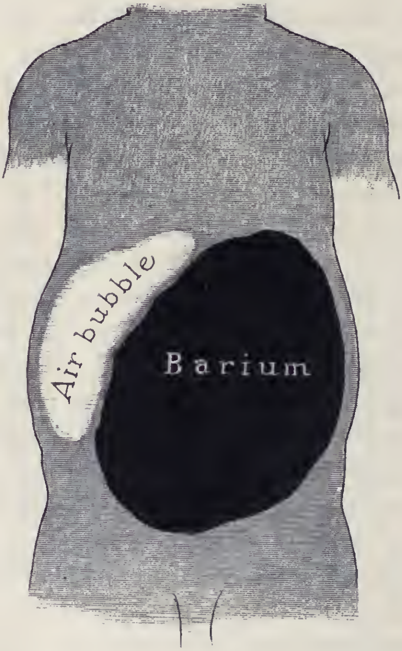

Fig. 433.—Megacolon in a male patient twenty-eight years of age. Sigmoid and descending colon accepted a tremendous amount of barium when given by enema under the fluoroscope.

Under ether the hernia was exposed, but because of difficulty in reducing it the abdomen was opened by midline incision. After considerable effort the sigmoid was returned to the abdomen. It was then seen that the sigmoid showed a tumor mass the size of a fist. The tumor was annular, involving the entire gut, irregularly nodulated, firm, and sharply outlined from normal bowel tissue. The patient had had no bowel distress at any time, had shown no blood in the stools, and had had no disturbance other than that which might be caused by any incarcerated hernia. The abdomen was closed, with the intention of doing a secondary operation. Six weeks after operation the patient was referred to our service for a radical removal of the tumor in the sigmoid. Through the old scar the abdomen was opened in the presence of the surgeon who had operated previously. Exploration of the abdomen and entire large bowel showed a normal intestinal tract throughout. There was some slight induration of the sigmoid, but the tumor mass had disappeared.

The diagnosis in this case was chronic sigmoiditis. The patient was kept under observation for a year following operation and showed no symptoms suggestive of any further disturbance. This case belongs to one of the groups which are frequently mistaken for carcinoma. Chronic sigmoiditis not infrequently occurs where a loop of bowel is held for a month or years within a hernia.

Diverticulitis of the sigmoid not infrequently has all the earmarks of a carcinoma, and not infrequently the patients are given a colostomy, with the understanding that their life will terminate in six months or a year. At the end of the allotted time the patient is in full health and strength and fluoroscopic examination of the distal loop will show the mass has gone. This type of case may be the source of some of the marvelous cures attributed to some of the various healing cults. A positive diagnosis should be backed up by the microscope whenever possible.

Mr. F., age twenty-eight, was referred to our service with the diagnosis of tumor of the ileocecal region, probably appendical in origin. The patient gave a record of irregular colic in the lower right quadrant, some tenderness on pressure, and a normal temperature throughout the period of hospital observation, four days preliminary to operation. Leukocyte count was 11,000. Stomach, stool, and urinary findings were negative.

Incision in the right flank showed a tumor mass the size of a fist involving the cecum and ascending colon and extending slightly into the ileum. The appendix was free from the disease, protruding outside the mass for its entire length. No enlarged glands were found in the mesocolon. A diagnosis of tuberculosis or carcinoma was suggested. A resection involving the distal portion of the ileum, ascending colon, a portion of the transverse colon, mesocolon, and involved glands was done. A lateral anastomosis of the small bowel and transverse colon was made. The patient made an uneventful recovery. The specimen showed a hypertrophy of the walls of the colon. The greater portion of the bowel wall in the diseased area was approximately an inch thick. Sections of the hypertrophied zone showed no carcinoma and no histology suggestive of tuberculosis. The tissue everywhere was simple fibrous hyperplasia, with marked round-cell infiltration. A chronic hyperplastic colitis, probably resulting from a diverticulitis at some time, was the final diagnosis.

Miss C., age twenty-six years, was referred to our service for closure of a double fecal fistula. A brief summary of her history was that she was operated on primarily, four years before, for appendicitis. The wound was opened for the second time for abscess formation and a tube inserted. A fecal fistula resulted and persisted in spite of two subsequent operations for closure. Following the last effort a second fistula opened through the midline scar, leaving the patient with two fistulæ through the midline scar and one through the appendical scar. The patient at this time had dropped to 80 pounds and was bedridden. Efforts to close these fistulæ by means of bismuth paste injections failed.

Several months had elapsed between the last operation and admission to our service, and it seemed that sufficient time had been allowed for the fistulæ to heal over.

An incision through the left rectus parallel with the umbilicus was made in the hope that the lower abdomen could be explored without contamination from the intestinal discharge. In the lower abdomen was found a mass composed of the pelvic organs, large bowel, omentum, and approximately 20 inches of the ileum. Scattered over the viscera and peritoneum were numerous tubercles. There was a moderate amount of free fluid in the abdomen. The 20-inch section of the ileum was determined by exploration. A uterine sound was carried into the appendical fistula and carried upward through the ascending colon until it could be identified by the hand within the abdomen. The direction of the sound was then shifted until it could be carried through the small gut downward to the openings which were in the midline scar. The sound was then reinserted through the midline fistulæ and carried through the small gut until it could be pushed into that portion of the ileum which was entering the adhesive mass. The ileum was resected at a point just proximal to where it entered the mass. The ascending colon was resected about its midline. All four openings were turned in. That portion of the ileum which was now lying free in the abdomen was brought up and attached to the transverse colon. Thus we left a tract of approximately 20 inches of ileum and a small portion of the ascending colon in a continuous tract which was isolated from the rest of the intestinal tract, but which communicated with the skin through the fistulous openings in the abdomen. Tissue removed at operation showed the histology of tuberculosis.

As soon as the patient could be moved the abdomen was given *x*-ray treatments, and later the patient was carried into the sunshine and the entire body exposed directly to the rays of the sun in the manner suggested by Rollier. The browning of the skin was begun by a few minutes' exposure of the various parts of the body each day until finally the young woman was sent to the country, where it was possible for her to live in the sunshine practically all day, with her entire body exposed to the sunshine. In six months she was as brown as an Indian, and had gained 40 pounds. Three years have now elapsed since the patient left the hospital. She has gained 60 pounds and is earning her own living. There is a small daily discharge of mucus from the fistulæ. This is cared for by a bit of gauze held in place by adhesive tape.

Many persistent, multiple fistulæ of the ileocecal region prove to be tuberculous. Good results are obtained by a lateral anastomosis and resection, either primary or secondary.

Mrs. F., age forty-eight years, was referred for operation with the diagnosis of cancer of the rectum. Twenty-five years previous she went through an illness that apparently was a vaginal gonorrheal infection, which later was carried into the rectum. For years after the vaginal discharge had disappeared the rectal affair continued and became more distressing. There was a profuse discharge of pus, increasing difficulty in defecation, which on admission was rapidly approaching a complete obstruction, and the development of numerous fistulæ.

Examination showed numerous fistulæ about the anus, some of them opening far out on the buttocks. The anal orifice would admit nothing larger than a urethroscope. Tissue was removed at various levels up to a point that would correspond to 2 inches of the ampulla. A barium enema showed a lumen stenosed to $\frac{1}{4}$ inch extending to the level of the sigmoid. As no malignancy could be found in the tissue removed, the diagnosis of benign inflammatory stricture was made.

Through an abdominal incision it was seen that the disease extended to the sigmoid for an inch above the culdesac. The bowel was brought out on the abdomen for a permanent colostomy and the entire distal segment of the large gut resected. The specimen removed showed a massive stricture of the rectum with a radial thickening of scar tissue of an average of 1 inch. The bowel lumen passing through the scar averaged about $\frac{1}{4}$ inch in diameter. A large part of the canal was denuded of mucosa. No malignancy was found.

The fistulæ connected with the bowel at irregular levels extending through the scar to the lumen.

Eight years have elapsed and the patient is enjoying good health at present. Fortunately, this patient had a large, sigmoidal loop and a long mesocolon which permitted the sigmoid to drop low in the pelvis and then ascend to the colostomy opening. This dependent portion of gut acts like the ampulla on the rectum and accumulates a considerable portion of feces before emptying (Fig. 434).

Many patients with a colostomy of this type flush the bowel once in twenty-four hours and have no further difficulty. The escape of gas is controlled by a metal cup held in position by a belt (Fig. 435). Between the cup and skin is a small rubber ring to prevent irritation and maintain cleanliness. A small pad of moist cotton is carried in the cup to prevent the rapid egress of gas. The metal cup is a great advantage over the rubber bag, as it can be boiled and all odor removed. The patient usually has two metal cups and several rubber rings, so that there can be a daily change to prevent all odor.

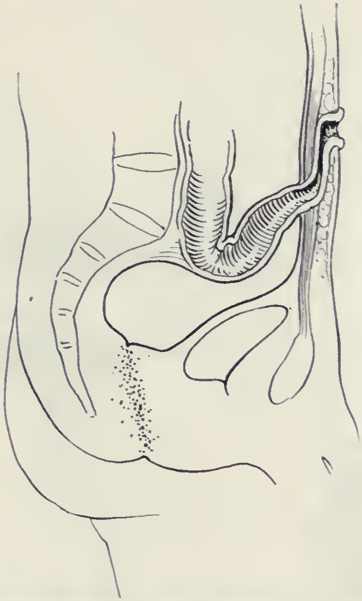

Fig. 434.—Sketch indicating a favorable type of colostomy. A dependent loop of gut hanging in the pelvis. This loop accumulates feces rather than expels them as soon as they reach this region. Patient with this type of colostomy obtains good control by a daily flushing of the contents which accumulate in the upper portion of the bowel. The gut is brought through the muscles and skin at different levels, giving a point of application for pressure by the colostomy cup.

When there is a long mesosigmoid and sigmoid an abdominal anus is far superior to the sacral opening, as the patient has better control of bowel movements, has fewer bowel movements, and has visual control of the situation.

Where the sphincters must be sacrificed and it is decided to terminate the colon on the abdomen, at times it is not necessary to remove the entire gut distal to the colostomy. The increased mortality of the combined operation is due to the traumatism caused by going through the pelvic diaphragm. If the tumor mass is in the lower ampulla one may remove the diseased and suspicious tissues and leave the upper ampulla and the remainder of the rectum terminating in the manner of the usual Kraske

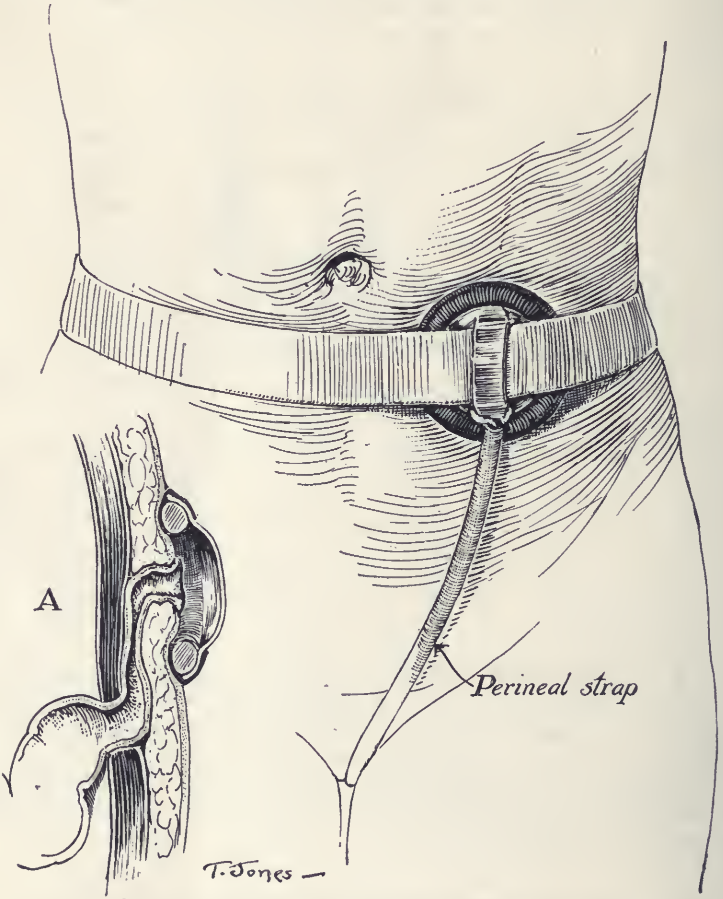

Fig. 435.—A simple and efficient colostomy cup.

operation (Fig. 436), that is, a sacral anus. Previous to this stage the colostomy should have been done in the usual manner with a long dependent loop.

Carcinoma, when located at the junction of the rectum and sigmoid, or at the level of the floor of the pouch of Douglas, does not offer the same prognosis as the above procedure. The immediate operative mortality is higher and the ultimate prognosis is not good because of the possibility of carcinomatous tissue being left behind (Fig. 438). Having had this experience, it seems to us better, where the tumor mass involves that portion of the gut immediately below the peritoneal gut, to do a permanent colostomy, resect the high-lying rectosigmoidal tumor, and leave the ampulla in place permanently.

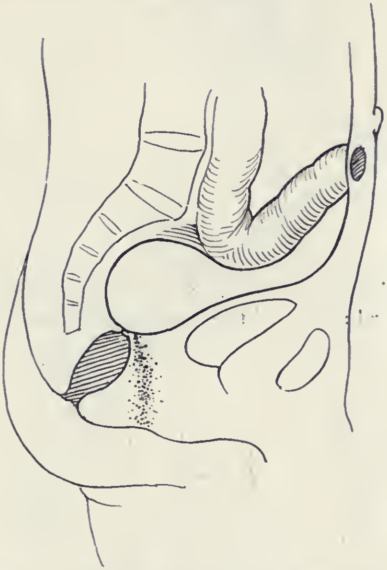

Fig. 436.—Sketch indicating the plan of technic for tumor located in the anal canal and lower ampulla. A properly constructed colostomy is superior to the artificial anus to the side of the sacrum. For this reason a preliminary colostomy is done, the carcinoma and lower ampulla are resected, and the stump of the gut lying within the pelvic defect is terminated high up between the buttocks. The dotted area indicates the course of the ampulla. The operative mortality is greatly lowered by this technic.

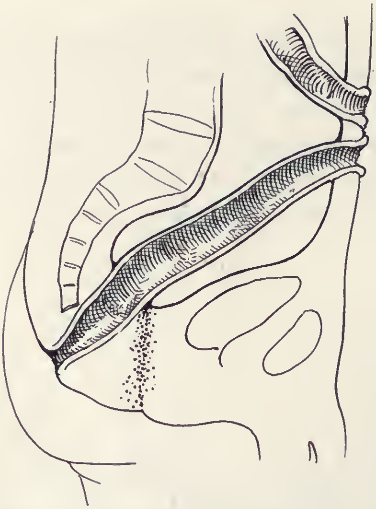

Fig. 437.—This patient entered the hospital with a history of ileus and was given a preliminary colostomy. A carcinoma of the lower ampulla was removed by the sacral route and the gut terminated as shown in the sketch.

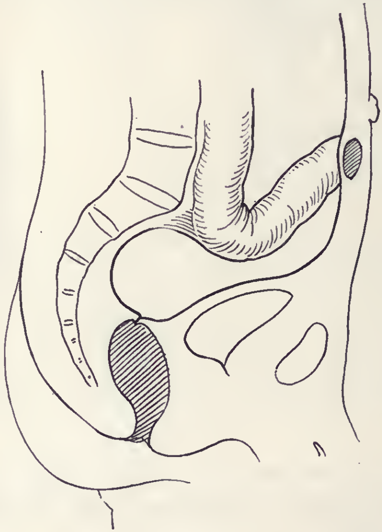

Fig. 438.—Sketch indicates the technic employed in very old or stout persons with carcinoma located at the rectosigmoidal junction where it is necessary to shorten and simplify the technic as much as possible. The carcinoma is resected. The distal end of the gut is turned in, covered with peritoneum, and the proximal end is brought out through the abdomen. This procedure lowers the mortality.

The next patient shows an interesting clinical record. A man sixty-eight years of age was referred to our service for a bleeding, ulcerating, protruding mass at the anal orifice. There was a record of frequency of urination, the patient arising several times a night for a number of years. In the year prior to admission he had lost 20 pounds in weight. For the last thirty years he had suffered at irregular intervals with hemorrhoids. At times the condition became unmanageable, and it was necessary for him to go to bed with hot applications until the crisis was passed.

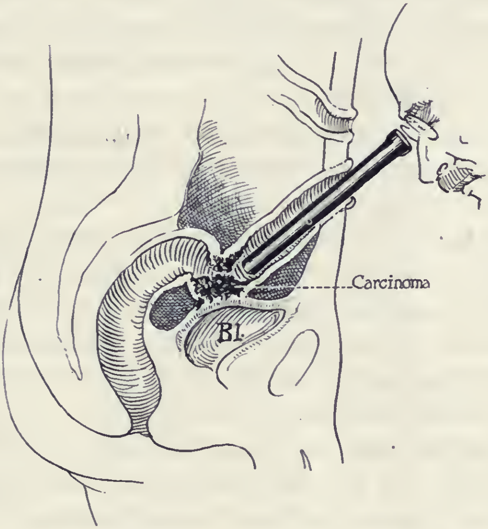

Fig. 439.—Sketch indicates the pathology described in the text, where an emergency colostomy was done. The tumor was located in the sigmoid and adhered to the bladder, but could not be detected by proctoscopic examination through the rectum. At operation there was some uncertainty as to whether the tumor was malignant or a benign diverticulitis. Proctoscopic examination was completed through the colostomy and a bit of tissue removed for diagnosis.

A week before entering the hospital the hemorrhoidal mass protruded again. This time he was unable to control the situation, and came to the hospital for help.

Up to six weeks before entering the hospital the patient had

had little or no gastro-intestinal distress other than that mentioned above. There was occasional constipation, but no record of obstruction or the use of cathartics. Then a bloody diarrhea began and persisted until operation.

General physical examination showed condition normal for a man of sixty-eight. Examination of the anus showed an ulcerating hemorrhoidal ring. Digital examination of the rectum showed a normal mucosa throughout. In the region of the prostate an indurated tumor mass was felt. The mucosa was intact in this region. The proctoscope was passed and showed a normal rectal mucosa to the height of 14 cm. Cystoscopic examination showed a normal bladder mucosa, a moderate enlargement of the prostate, and a pronounced bulging inward of the bladder just above the prostatic level.

A barium enema was given under fluoroscopic control. The barium was seen to ascend to the sigmoid, hesitate for a time, and then pass into the descending colon, leaving a defect of 1 to 2 inches. The diagnosis appeared to be carcinoma of the sigmoid adherent to the bladder, with an exacerbation of the old hemorrhoidal condition.

The sloughing mass of hemorrhoids was cleaned up under local anesthesia. A few days later under gas anesthesia the abdomen was opened, explored, and a permanent colostomy established. The sigmoidal tumor was adherent to the bladder and pelvic wall. Later a proctoscopic examination through the colostomy opening showed a carcinoma.

The following history is characteristic of the insidious onset of a carcinoma in the sigmoid:

The patient, a man sixty-six years old, had always enjoyed vigorous health, and up to a week before entering the hospital felt that he was perfectly normal. There had been no obstruction or irregularity of the bowel movements. There had been normal stools until a week before entering the hospital. At that time the man found some difficulty in the stool. While making an excessive effort to empty the bowel he had a sudden, sharp pain low in the pelvis, and was immediately able to pass a stool with a considerable amount of blood. Following this he was prostrated for an hour or two, but was able finally to return to his home. He consulted a physician, who urged him to go to the hospital for a more thorough examination because of the unusual history. After forty-eight hours the patient felt so much relieved that it was with difficulty that he was prevailed upon to enter the hospital.

Digital examination failed to show any tumor mass. Proctoscopic examination was negative to the level of 15 cm. Barium injection under fluoroscopic control showed a stenosis of the bowel in the middle of the sigmoidal loop.

On entering the hospital the urine was normal. The patient was in the hospital under observation for a week before operation. The urine gradually showed a change. There was an increase in the leukocytes. Bacteria suggestive of colon bacilli appeared. Forty-eight hours before operation the patient had a chill and rise in temperature, with pain in the region of the left kidney. On account of the gradual increase in obstruction it was thought advisable to operate at once.

Under ether anesthesia the abdomen was explored through a midline incision. The anterior and posterior surfaces of the liver were normal. The peritoneum of the upper abdomen was normal. Aortic glands were normal. In the lower abdomen a tumor of the sigmoid was adherent to the bladder by an area approximately 3 inches in diameter. The omentum was adherent to the colon, bladder, and pelvis. The mesosigmoid showed a brawny induration. No definite glands, however, were visible.

Because of the man's age, the recent bladder disturbance, and the firm adhesion between the bladder and bowel it seemed best not to attempt a primary resection, especially as it was a question between carcinoma and chronic inflammation of the large bowel. A colostomy was established. At the time of operation a tentative diagnosis of carcinoma was made, with the possibility of an inflammatory affair. A proctoscope was passed into the distal loop of the colostomy and a cauliflower-like tumor mass was seen. A small portion was removed and found to be an adenocarcinoma. Radium was inserted into the tumor mass through the colostomy opening. A definite opening between the rectum and bladder developed after operation. The proctoscopic examination failed to send air into the bladder at the preliminary examination. The examination made at the time tissue was removed two weeks after operation resulted in a distended bladder and passage of air through the urethra.

The latency of malignancy in this case is typical of many large bowel carcinomata and is one of the reasons why the patient reaches the surgeon in an inoperable stage.

Cancer of the rectum is frequently overlooked and mistaken for hemorrhoids by reason of the fact that digital examination is not made. The following case, however, would indicate that rectal cancer may be as insidious as cancer of the colon:

A young woman twenty-eight years old was referred by her family physician for a rectal disturbance that was first manifested by a severe hemorrhage occurring with a stool two weeks before entering the hospital. Previous to the single rectal hemorrhage there had been absolutely no symptoms. Examination showed an annular growth in the ampulla of the rectum, readily found by the finger. A colostomy was done and the entire rectum was removed. The growth was found to extend along the lumen of the rectum for 3 inches.

Miss P., nineteen years old, had the following record: Usual diseases of childhood and a normal pelvic history. For five years before admission she had no specific trouble, although she had not been very strong. Up to the time of the onset of the present complaint the patient had no gastro-intestinal distress. One week before entering the hospital she complained of colic in the right lower quadrant. At the end of twenty-four hours a physician was called, whose report showed that there was moderate tenderness in the region of the appendix with a normal temperature and a leukocyte count of 8000. On the following day a mass the size of a goose egg was palpated. On the third day the mass had disappeared and on the fourth day she was admitted to the medical side of the hospital. The patient showed a normal temperature, normal stomach findings, negative stools, normal leukocyte count, and hemoglobin 85 per cent. At irregular intervals during the day the colicky pains were noted in the lower right quadrant, but no mass was discovered during the period of observation. As the colic persisted there developed an increasing tenderness in the lower right quadrant. The patient was transferred to the surgical side for exploration. On the morning of operation a mass in the right flank, the size of a hen's egg, was observed.

Under ether anesthesia an incision was made over the ileocecal region. Examination showed intussusception of the small bowel into the large. The intestine was readily reduced. A small tumor mass was then felt in the cecum. Enlarged glands in the mesocolon in the region of the ileocecal valve were found. Enlarged glands were found throughout the entire distance between the colon and the aortic group, although no enlargement of the aortic glands could be determined.

Eight inches of the ileum and the large gut up to the transverse colon, with the involved portion of the mesocolon and glands, were removed. A lateral anastomosis between the ileum and transverse colon was accomplished and the transverse colon, omentum, and mesocolon were used to cover in the raw surfaces.

Examination showed the tumor mass to be an adenocarcinoma. The glands removed were divided into three groups, those nearest the bowel, those close up to the root of the mesocolon, and an intermediate group. All three groups showed adenocarcinoma.

The patient left the table in moderate shock, but rallied promptly and left the hospital in three weeks.

Because of the fact that carcinoma of the large gut progresses so rapidly in young people that it is usually beyond the limits of radical removal before a diagnosis is made, and because the three groups of glands showed malignant metastases, it seemed that a bad prognosis was evident.

Three years have elapsed and the young woman is still in good health. This case is interesting because it is the reverse of the usual prognosis of carcinoma of the large gut in young people, and encourages one in attempting the most extensive type of resection.

Mr. S., aged forty-nine, reported to the hospital for pain in the lower abdomen, constipation, and a loss of weight of 20 pounds. Six months previously he first noticed distress in the lower abdomen which was more frequent just after eating. The distress usually lasted from one to three hours. A glass of hot water frequently gave relief. There were no acid eructations and no gas. He had used castor oil at irregular intervals for twelve years. Later he used it almost daily.

At the time of entering the hospital his bowels were moving each day. Stools were normal in caliber and contained no gross blood or mucus. Appetite had been good. He slept well and had no unusual symptoms other than occasional distress in the lower abdomen. He showed 3,200,000 reds, 7000 leukocytes, and hemoglobin 60 per cent. Stomach analyses were negative. Repeated examination of the stool showed blood both by Weber and benzidin tests. Urine was negative.

Physical examination showed a fairly well-nourished male, somewhat pale, with normal findings in the head, neck, and chest. In the region of the ascending colon a tumor mass was readily palpable. Under fluoroscopic control a barium enema was passed into the rectum. It gave a normal contour of the large bowel until the barium mixture reached a point a few inches distal to the ileocecal valve. Here the solution stopped abruptly. Although the bowel was distended rather vigorously, distal to the tumor mass, it was impossible to pass through any quantity of barium. The barium meal passed readily through the stricture, showing a constriction at the point of the tumor.

The patient showed what is seen so often in these cases, a valve-like arrangement of the carcinomatous mass. The fecal current will pass through from the proximal side, but when an endeavor is made to force the barium enema against the carcinoma and in through it, a villous-like growth of the carcinoma apparently collapses and gives us a non-patent obstruction.

Under ether anesthesia the abdomen was opened by incision in the right flank. The abdomen was explored and an annular constricting mass was found in the ascending colon 2 inches above the ileocecal region. Numerous glands were found in the mesocolon and in the immediate vicinity of the mass. Enlarged glands were strung out in an irregular manner upward and inward to a point at the level of the duodenum. The ileum was severed at a point 3 inches proximal to the ileocecal region, and the transverse colon was severed at about its midpoint. The ileocecal region, ascending colon, hepatic flexure, mesocolon, and the glands up to the aorta were removed in a mass. A lateral anastomosis between the ileum and transverse colon was made in the usual manner, and the abdomen was closed without drainage.

The tumor mass proved to be an adenocarcinoma surrounding the gut and involving approximately 2 inches of the colon. The lymph-glands on section showed a simple inflammatory reaction.

CLINIC OF DR. CHARLES A. PARKER

HOME FOR DESTITUTE CRIPPLED CHILDREN
(OUT-PATIENT DEPARTMENT)

A SERIES OF ORTHOPEDIC CASES

Summary: Eleven cases of infantile paralysis; three of tuberculosis of the hip; three of tuberculosis of the spine; one old fracture of the femur wearing a Lane plate; one adolescent bow-legs, and one osteomyelitis of tibia with transposition of the fibula.

INFANTILE PARALYSIS

THIS child is four years old. Three months ago, after an attack of fever with headache, the child's lower limbs became weak and he was unable to walk. He was taken to theCounty Hospital, with a diagnosis of infantile paralysis. He remained in the hospital eight weeks and recently returned to his home.

He is now wearing full length leg casts made bivalve for removal. This is a prophylactic measure now regularly used in the County Hospital and Durand Hospital, our two quarantine hospitals for infantile paralysis. The application of casts or other fixing apparatus practically insures against deformity from unbalanced muscles, and is used in all cases where there is potential deformity, as, for instance, when the anterior tibial group of muscles is paralyzed we know equinus will result unless the foot is protected from the constant action of the gastrocnemius and soleus, or a valgus after paralysis of the tibiales. This is usually done in the quarantine stage, the first four to five weeks, when there is never much difficulty in putting the limbs in the proper position of extension at the knees and with the feet at right angles with the legs both anteroposteriorly and laterally. With the casts off while lying on his back he can maintain either leg extended at the knee and elevated from the table for a short time. That means that his extensors of the knee and flexors of the hip are competent, although not necessarily full strength.

The right foot inclines to equinus, with slight valgus, but apparently all muscles are acting.

The left foot inclines more strongly to equinus and valgus and the tibialis anticus is not observed. There are general movements of the toes in both feet. The child is somewhat peevish and does not co-ordinate well in the tests, so complete reactions are not always obtained in the short time given to the case in the clinic where we have many to care for during the afternoon. We do, however, try to ascertain the salient features so as to guard against deformities, and then make more complete muscle surveys at our leisure. Much of this part of the work is now done by the specially trained nurses of the Visiting Nurse Association assigned to infantile paralysis cases.

The abdominal muscles are apparently effective, although complete examination is not feasible with the patient's present lack of co-operation. However, we will keep him lying down to protect this region and replace the casts upon his legs to maintain this present good position while awaiting gradual recovery of the cord lesion and resumption of muscle functions. The upper extremities are competent, that is, they can perform all their normal functions without determining their variations from normal strength. The thumbs, however, show weakened action of the opponens pollicis more apparent in the right than in the left. Next to the deltoid, Lovett says this is the most frequently paralyzed muscle of the upper extremity.

While we are in the habit of considering difficulties of locomotion as the most serious result of infantile paralysis, on account of their particularly obtrusive character, that is immediately apparent, yet, the paralyses of the upper extremity, affecting seriously the more varied and complex functions of the arms and the hands, are really the greater handicaps. A person can walk with an artificial leg, but there is no substitute for the human hand.

The next patient is a child of twenty months, who has recently left the County Hospital after quarantine for infantile paralysis.

It first came to our clinic a few weeks ago wearing a cast on the right leg. It can now maintain the leg extended at the knee, but as the foot is still inclined to valgus we advise an elevation of the inner half of the sole $\frac{1}{4}$ inch.

The next 9 cases are older cases of infantile paralysis, some that have been under our control since the original attack, with no resulting deformities, and others coming with more or less extensive deformities demanding corrective procedures by operation and apparatus.

What is so easy to maintain by early and proper treatment is often very difficult or even impossible to obtain by later orthopedic measures. It is our rule of practice never to put a brace on a deformed limb, if there is any possibility of overcoming the deformity first. This refers particularly to the lower extremity. When the knee completely extends and the sole of the foot rests properly on the floor, although the muscles may be completely paralyzed throughout the limb, this position of the limb is easily maintained by a brace when the whole weight of the body is put on the limb in walking; in fact, often the limb will maintain the weight without the brace when the extended knee throws most of the weight in front of the axis of flexion. A brace allowing no movement at the knee in walking, however, adds to the security. Where knee extension is imperfect the brace is absolutely necessary to prevent collapse when the body weight is put on the leg. Figures 440 and 441 show a good form of brace with a joint at the knee that remains locked when standing, but by means of a handy contrivance can be bent when sitting. This brace has a foot-piece to which the foot is strapped before it is put in the shoe.

A brace can be fastened to the outside of the shoe where the foot is normal, which is rarely the case when a long splint is needed. No ordinary shoe can be depended upon to maintain a deformed or disabled foot in shape, and no apparatus on the outside will take the place of a definite fixing apparatus, independent of the shoe, on the inside. In the rarer cases, where the

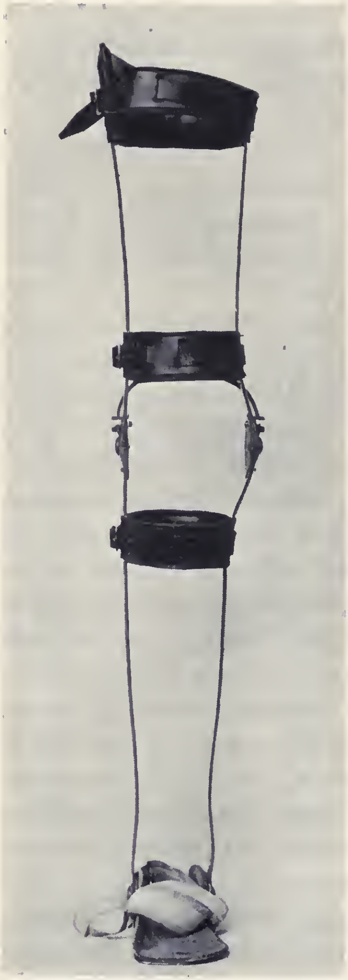

Fig. 440.—Full length leg brace, with joints at knee and ankle and bale lock at knee. Front view.

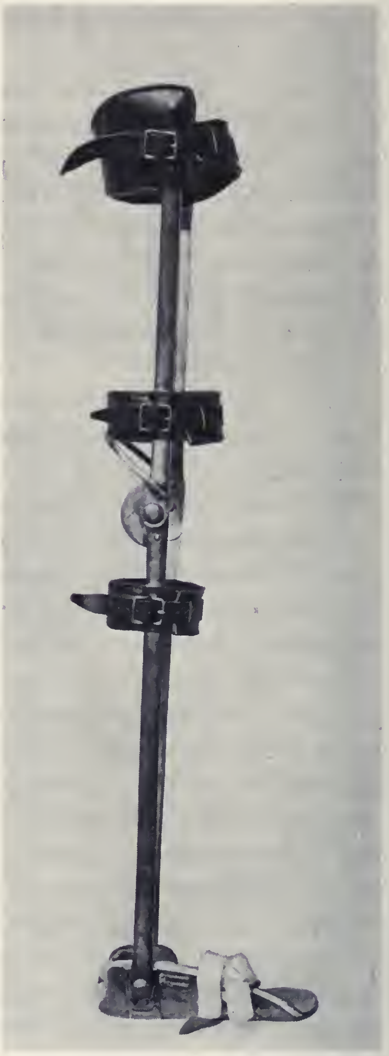

Fig. 441.—Full length leg brace, with joints at knee and ankle and bale lock at knee. Side view, showing details of joints at knee and ankle and the bale lock at the knee.

inside foot-piece can be dispensed with and the brace fastened directly to the shoe, it requires the services of an expert to change one's shoes. With the foot-piece connected with the brace shoes can be changed by the patient as often as desired. You observe we do our own measuring for braces, either by tracing the limb on paper or by making a plaster-of-Paris pattern to send to the instrument maker. Further care of these cases you will see from time to time as these and others cases come to the clinic during the course.

We will have something to say of muscle training in these cases at some other time, but this should always be kept in mind, that where there are no muscles there will be no result from their training.

OLD FRACTURE OF FEMUR STILL WEARING LANE PLATE

I operated upon this child at the Children's Memorial Hospital six years ago for an overlapping fracture of the right femur. The child had also had a previous attack of infantile paralysis affecting the injured limb. The mother comes now to see if anything more can be done for the paralysis. The plate is still in place and causes her no inconvenience.

I believe that the Lane plate is the simplest contrivance yet invented for holding recent fractures in position, and, being the simplest, it is also the safest. It requires the minimum operative procedure to place and reduces the shock of an operation accordingly. Of course, it should be used only when simpler non-operative means are not satisfactory. It can be removed after performing its function when it is superficially situated and liable to injury, or when it becomes loosened or a menace from any cause by a small operation with very little operative risk.

TUBERCULOSIS OF THE HIP

This boy who is now seven years old first came to us when he was four years old with a history of several months of increasing trouble with the left hip. He would suddenly awaken in the night crying with pain in the hip and knee. He also limped when he walked. At the time of the original examination the left hip could be flexed 90 degrees and there was limitation in extension, abduction, and rotation. An *x*-ray at the time left us in doubt as to the pathology, but the hip and leg were put in a plaster spica. He was then kept in casts which were changed at intervals of six to twelve weeks, with little change in local symptoms until in August, 1918, when he had severe pain in the hip. In May, 1919 an abscess was detected on the front of the thigh, confirming the tentative diagnosis of tuberculosis. According to our usual procedure this was not opened, but kept in the cast with a window over the abscess to allow of spontaneous rupture. This abscess opened in January, 1920. As the parents had been told not to be alarmed when it opened, but to dress it with sterile gauze until they could return to the clinic, it was three weeks before they came to us, the sinus still discharging and the boy quite comfortable. This is our rule in the treatment of tuberculous abscesses from joint disease in children, to allow them gradually to open spontaneously. This has two advantages: first, in a number of cases the abscess disappears without discharging, and, second, in those that do discharge the long process of round-cell infiltration of the superficial tissues prior to rupture appears to exert a distinct prophylaxis against violent reaction that frequently occurs when they are opened operatively. Puncture and injection have not recommended themselves, as they quickly refill with fluid, and the chance of the injection reaching the infecting focus is quite remote. Even if it did reach it, there is little evidence that it would exert a beneficial action. In the hands of the originators of the treatment Beck's paste injected into the sinuses has exerted a beneficial, if not specific, influence in these cases; but it is now used comparatively little by orthopedic surgeons, as the results obtained have not come up to their expectations.

This boy's sinus is now closed and the scar is drawn in toward the deep tissues due to the contraction of the fibrous tissue of the tract. This is rightly considered a good omen of approaching cure or at least termination of that particular abscess. The hip is still somewhat sensitive, so a new spica will be put on and the boy allowed to go home on crutches. He is now attending school while recovering from his hip disease. It may be six months or a year till he is safe to go without a cast or other apparatus. The joint must be entirely free from pain on attempts at movement, and the limitation of movement which usually occurs must be mechanical from fibrous adhesions and changed joint relations rather than from reflex muscle rigidity on guard during the active stage of the disease.

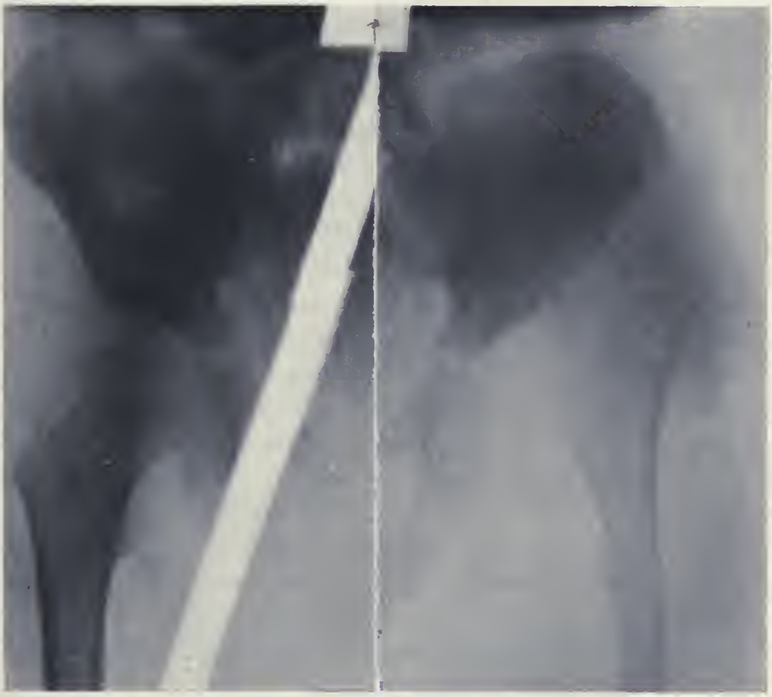

Fig. 442.—Active tuberculosis of right hip, with destruction of the head of the femur and upward displacement of the latter.

The next case appears before us for the first time. The child is four years old and suffering acutely. He is wearing a double Thomas hip splint which does not hold him well. The right hip is greatly swollen and tender. The trouble began eight months ago and has gradually developed. This is undoubtedly a case of tuberculosis. After an *x*-ray is taken a cast will be applied to the hip and the child put to bed.

(Later: Fig. 442 is the *x*-ray, showing extensive destruction of the head, neck, and acetabulum. The child was so much relieved by the cast that his parents took him away from the hospital four days later against our most vigorous protests.)

The next case is, briefly, an old tuberculosis of the left hip, now quite painless and healed, in this twelve-year-old girl. The leg as a result of destruction of joint elements is $\frac{1}{4}$ inch shorter than the right, but on account of permanent flexion of 45 degrees it appears 2 inches shorter than the right. This patient should have a subtrochanteric osteotomy of the short leg. This materially reduces the apparent shortening and allows the girl to stand much straighter and to walk with a less noticeable limp.

TUBERCULOSIS OF THE SPINE

The next 3 are cases of tuberculosis of the spine. This boy is seven years old and is wearing a plaster jacket, although he is apparently entirely healed. The disease has been under treatment between two and three years, and practically the only evidence remaining is the small but distinct kyphos at the dorsolumbar junction. As his cast has been on several months, it will be changed today. The new one is needed for protection against recurrence for six months or a year longer.

This boy is now ten years old and comes with this extreme kyphos in the middorsal region. It is very much worse than the previous case. You will observe this extensive scar in the region of the deformity. The history says an Albee operation was performed upon this child in 1913 by one of our orthopedic surgeons. The long scar on the left shin shows the source of the transplant. Four months after the operation apparently all supports were removed. The child evidently did well, as this is the first return visit to our clinic after seven years. I do not know whether the kyphosis has increased or not, but it could not be much worse. He comes now on account of limitation of motion in the right hip and a limp. There is also a small fluctuating swelling appearing under the lower border of the left ribs near the erector spinæ that is not reddened nor tender to touch. There is also some limitation to complete extension in the right hip—on the side opposite to the swelling. No other symptoms are present. No swelling can be detected in the iliac fossa, so the limitation of hip motion is probably due to psoas irritation of recurring spinal disease.

There is no absolute guarantee against recurrence, though fortunately in many cases it does not take place and healing is permanent. This child shall now have a plaster jacket and be treated as an active case.

This young man is lying on a Bradford frame, on which he was transported from his home to the clinic. He is in good flesh and color. His back, as you see, has an extreme kyphos composed of most of the lower dorsal vertebræ. The history shows that his trouble was present when nine years old, that he first lay on a Bradford frame in this hospital for six months, and after that wore casts or a brace for four years, when he was considered cured. For six years he was apparently well and able to work until last fall, when he came to us barely able to walk. He had loss of muscular control of the legs and the knee reflexes were greatly exaggerated. He was advised to go on a Bradford frame at once. He has been on the frame since then except for a brief interval the last month. His reflexes are now nearly normal. He has had some massage of the legs to limber up his joints. He is not to attempt walking for some time yet. There are no apparent abscesses and the boy will in all probability regain his functions if we make haste slowly.

BOW-LEGS IN AN ADOLESCENT

This young lady (colored) is now seventeen years old and is naturally very much concerned about the shape of her legs, which you will observe are extremely bowed. A peculiarity of this type of bow-leg is that the curve is all in the femur and not in the leg below the knee. When the parts below the knee are placed together you see they are straight. In practically all of the younger children the bow is below the knee and requires correction of the tibia and fibula for a cure.

This case will require an osteotomy of both femurs just below the condyles, the legs to be put in plaster cast for ten weeks to maintain the correction secured.

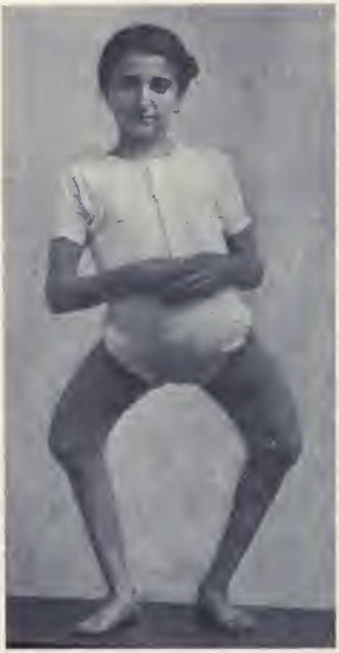

Fig. 443.—Bow-legs in a girl due to deformity in the lower end of the femur. (Photo loaned by Dr. Blanchard.)

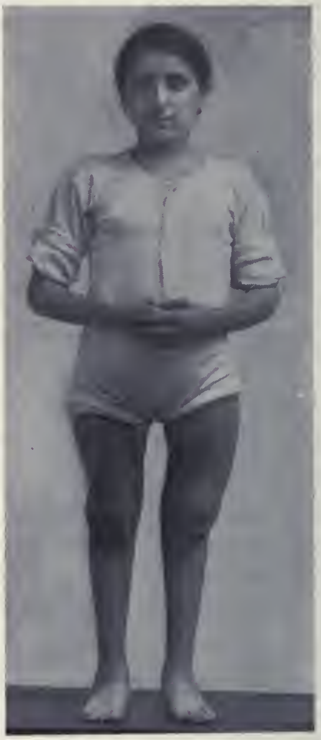

Fig. 444.—Same patient as Fig. 443 about three months later. (Photo loaned by Dr. Blanchard.)

These photographs show the results obtained in a similar case, and we shall expect the same result here (Figs. 443, 444).

OSTEOMYELITIS OF TIBIA WITH TRANSPOSITION OF FIBULA

This little girl came on our service three years ago with the history of a previous operation for osteomyelitis in which most of the shaft of the left tibia had been resected, resulting in an upward dislocation of the fibula and a bowing of the leg with the convexity outward. The tibia had not been reproduced after the operation. The record at first advises a transplant of a part of the right tibia to the left leg, but this was not done. After considering the probability of infection of a transplant embedded in an osteomyelitic area it was decided that transposition of the left fibula into the hiatus of the tibia would be more likely to succeed in the face of probable infection. Accordingly, this was done in June, 1917. The shaft of the fibula was severed at each end just short of the epiphysis, and a path

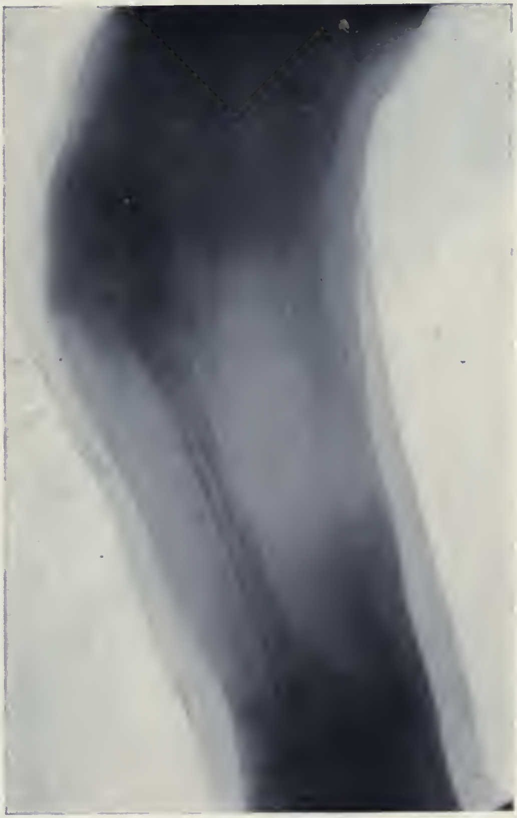

Fig. 445.—Transposition of fibula with the ends in relation to the remnants of the diaphysis of the tibia soon after operation. Position of leg faulty.

opened up between the anterior and posterior groups of muscles with the least disturbance of structures attached to the fibula. The ends were then embedded in the remaining stumps of the tibial shaft. The position was difficult to control even with a cast and the infection which developed. The series of x-ray plates will, however, show the progress of the case, and the good function of the leg, which is now quite stable, will endorse the method pursued (Figs. 445-447). The leg is about 2 inches shorter than the other, but it carries her weight well and does not give out. She has been wearing this brace to safeguard the position, and although she walks well without it, she wants it readjusted for further use.

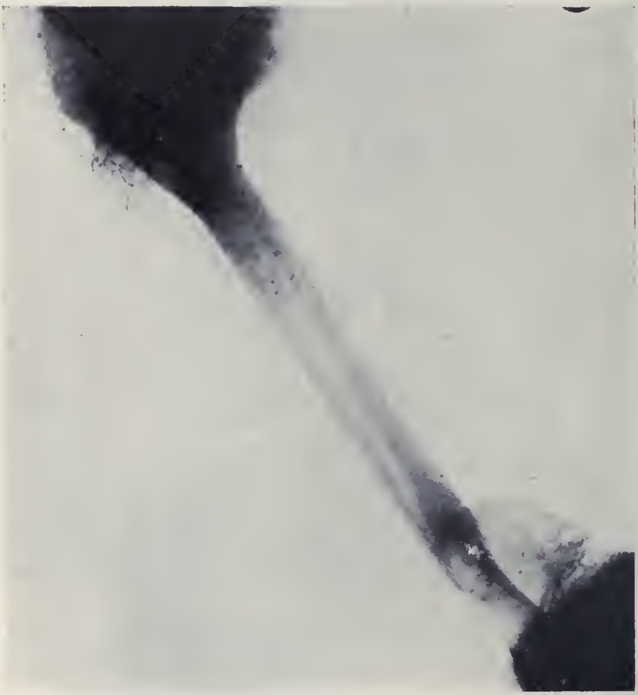

Fig. 446.—Same as Fig. 445 nineteen months later. Alinement better and fibula hypertrophied.

This is an extremely instructive demonstration of the physiologic quality of bone to adapt itself to its use—the principle expressed in Wolff's law.

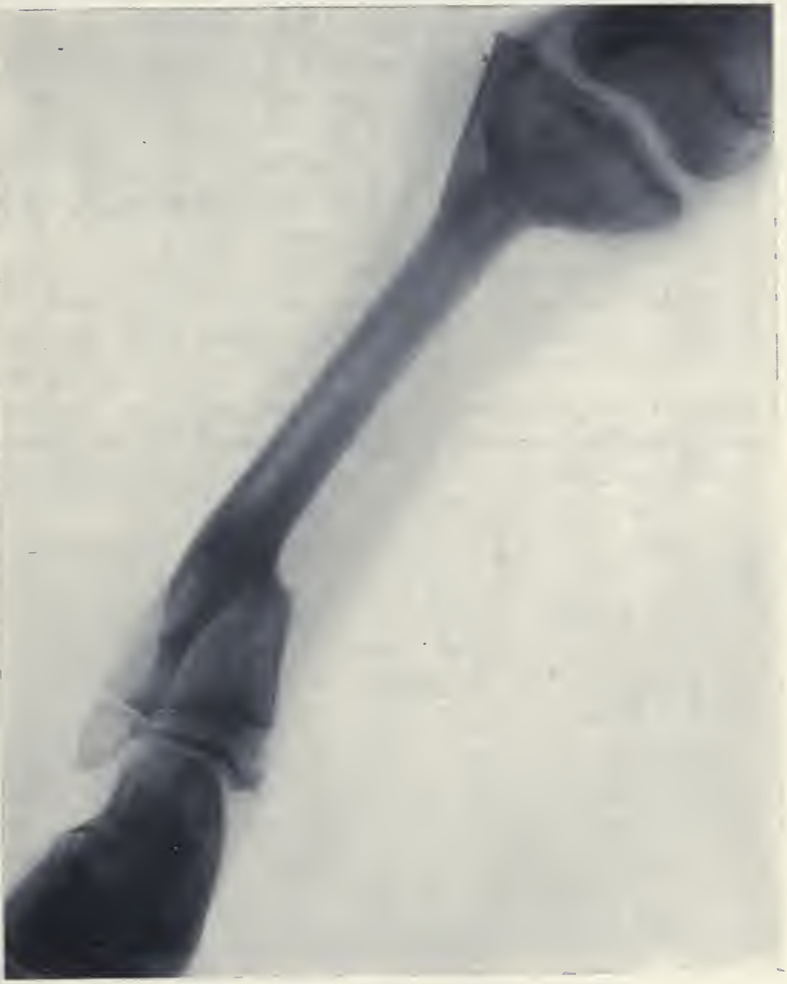

Fig. 447.—Same as Figs. 445, 446 fourteen months after Fig. 446, showing good alinement and union of the greatly hypertrophied transposed fibula with the remnants of the tibial diaphysis, while maintaining union with its own terminal fragments.

This transposed fibula is now nearly the size of a normal tibia, and much larger than a normal fibula ever becomes even in an adult. It is not ideally placed between the two portions of the tibia, but we agree that it is efficient. This case further exemplifies a recently promulgated unsound practice of early removal of the shaft of a long bone for osteomyelitis before the involucre has properly developed, a protective process that ordinarily takes several months. In the more fortunate cases of early removal the shaft is renewed from the osseous elements attached to the preserved periosteum, but there is no certainty that a bone will be thus reproduced, and in the present case it is quite apparent that it was not.

This would seem the least reprehensible where but one of the two bones of the leg is removed, but to advocate such practice in the single bones, as the humerus and the femur, with the expectation of later filling the gap with a transplant is the height of radicalism, not to call it something worse. We will now adjourn to the plaster room to put on such casts as we have advised during the clinic.

CLINIC OF DR. ALBERT E. HALSTEAD

St. Luke's Hospital

ILEOCOLIC INTUSSUSCEPTION PROTRUDING THROUGH THE ANUS: OPERATION AND RECOVERY

(Reported by Dr. Frederick Christopher)

Summary: Acute ileocolic intussusception in an infant of four months. Operation and recovery. Four types of intussusception. Mortality. Treatment.

Patient R. A., No. 136,821, a nursing infant of four months, was admitted to St. Luke's Hospital on March 22, 1920 as a boarder. The mother, on whom a diagnosis of cholecystitis was made, was admitted for observation, and discharged without operation. The infant had had a spontaneous birth and previous to admission had been in excellent health. The family history was negative.

At 7 P. M. on the day of admission, when brought to the mother, the infant refused to nurse and vomited 2 ounces of greenish material. Examination at this time showed that about 1 ounce of bright red blood had been passed from the rectum. At 8 P. M. there was no rigidity of the abdominal wall. Palpation of the left lower quadrant revealed a sausage-shaped tumor, which was approximately 3 inches in length by 1½ inches in width. It was firm and somewhat movable. On rectal examination there was a bulging downward when the tumor was pressed toward the pelvis.

Patient was first seen by Dr. Halstead at 8.30 P. M. At the time the latter operated, which was three hours after the first appearance of the symptoms, the ileum, which was the portion of the bowel constituting the head of the intussusception, presented at the anus (Fig. 448).

A midline incision was made immediately below the umbilicus. The neck of the intussusception was found to be in the upper midabdomen (Fig. 449). The large intestine was delivered to the surface of the abdomen and the invaginated small intestine manipulated toward the cecum. The ileum was pushed entirely out of the large intestine and the distal end of it just

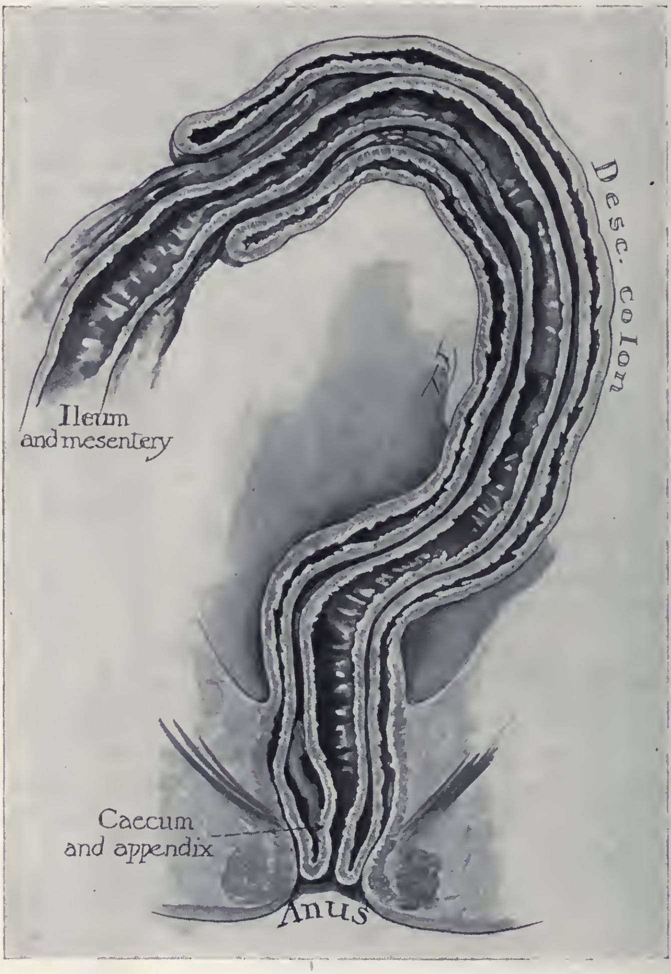

Fig. 448.—Cross-section showing extent of intussusception in present case.

above the ileocecal valve, which was darkened in color to a bluish black and had several areas of necrosis varying in size from 1 to 2 cm. in diameter, was covered with a small piece of omentum which had been cut off from its attachment. The ring of traumatized serosa and muscularis which marked the neck of the intussusception was infolded by suturing together the uninjured serosa on each side of it (Fig. 450). The abdominal wall was closed in layers without drainage.

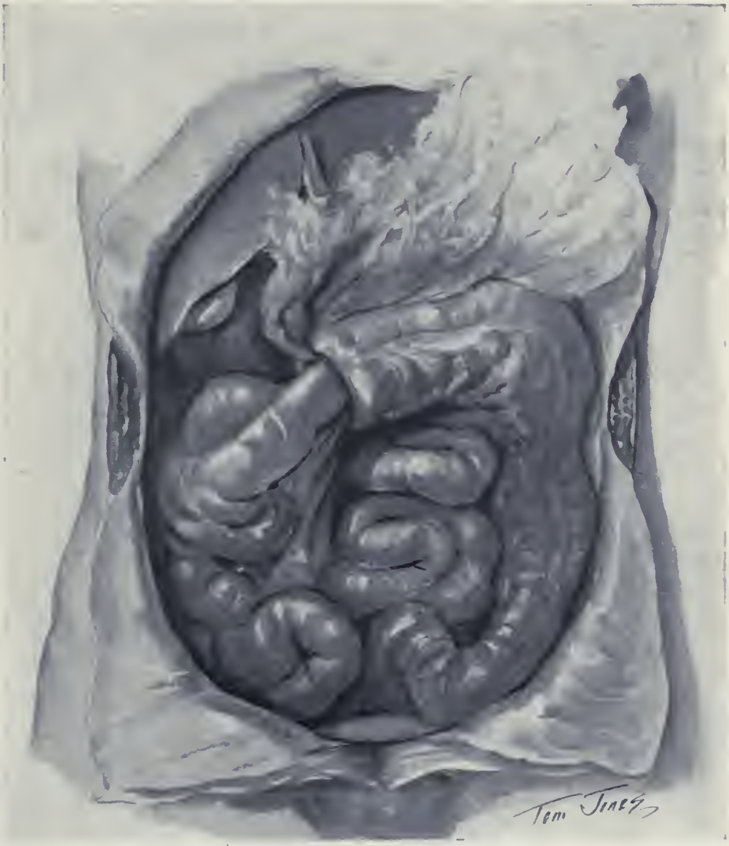

Fig. 449.—Diagrammatic sketch showing appearance of intussusception on opening the abdomen.

Postoperative Course.—The first day after operation the rectal temperature reached 103.6° F. and the pulse remained at about 150. The patient was given paregoric, 20 drops, every four hours for one day, and mother's milk 2 ounces every

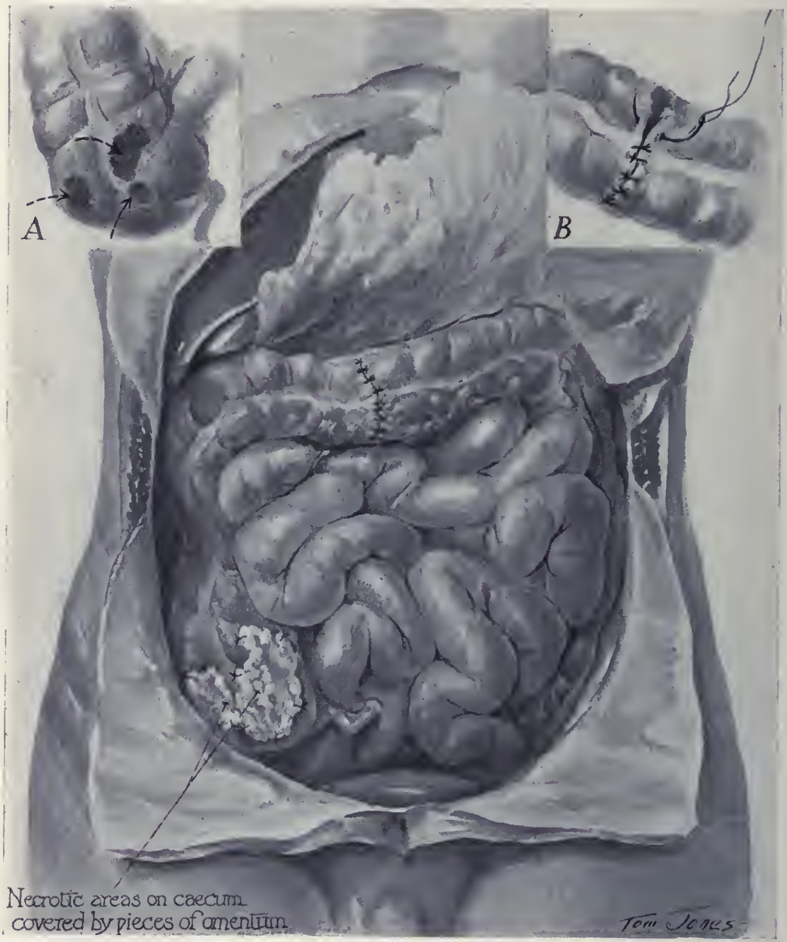

Fig. 450.—Diagrammatic sketch illustrating the method of repair employed.

three hours during the day. Thirty-five hours after the operation the patient had a large dark green stool tinged with blood, and from then on there were regular free bowel movements. On the fourth day the patient was given a nursing every two hours, which was followed by a formula. On the seventh day a furuncle in the external canal of the right ear was incised and an otitis media of the left ear was noticed. The stitches were removed on the ninth day and the patient was transferred to the Pediatric Service. The white blood count was 22,050 on the second day after the operation, and fell gradually to 17,850 on the seventh day after operation. The temperature was normal on the fourth day after operation and was not again elevated during the patient's stay in the hospital. The child was discharged on the thirteenth day after operation with wound cleanly healed and the bowel movements, temperature, and blood counts normal.

Discussion.—Intussusception is primarily a disease of young infants and is two to three times more common in males than in females. Holt collected 358 cases under ten years, and found the age of occurrence as follows: Under six months, 141; between six and twelve months, 89; between the first and second year, 32; between the second and tenth year, 96. Three-fourths of the cases in childhood, therefore, are in the first two years, and one-half of them between the fourth and ninth month.

There are four chief types of intussusception, namely:

1. The ileac or enteric (Fig. 451), where the invagination is limited to the small intestine and is not to be confused with the agonal ileac intussusceptions found at autopsy, of which there may be several in number.
2. The colic (Fig. 451), where the invagination is of the large intestine only.
3. The ileocolic (Fig. 451), in which there is invagination of the ileum through the ileocecal valve, and in which while the cecum may be invaginated secondarily, the ileum remains as the most prominent protruding portion.
4. The ileocecal (Fig. 451), which is the form most often seen. In this the cecum with the ileum behind it passes into the colon, the valve continuing to be the apex of the projecting portion.

There may also be retrograde intussusceptions where the lower part of the intestine is invaginated into the upper; there may be mixed types; there may be even double (Fig. 451) and triple (Fig. 451) intussusceptions; and even intussusceptions of the appendix, which Murphy thinks may cause enterocolic intussusception.

The entering cylinder of the invagination is called the intussusception, and the receiving cylinder the intussuscipiens.

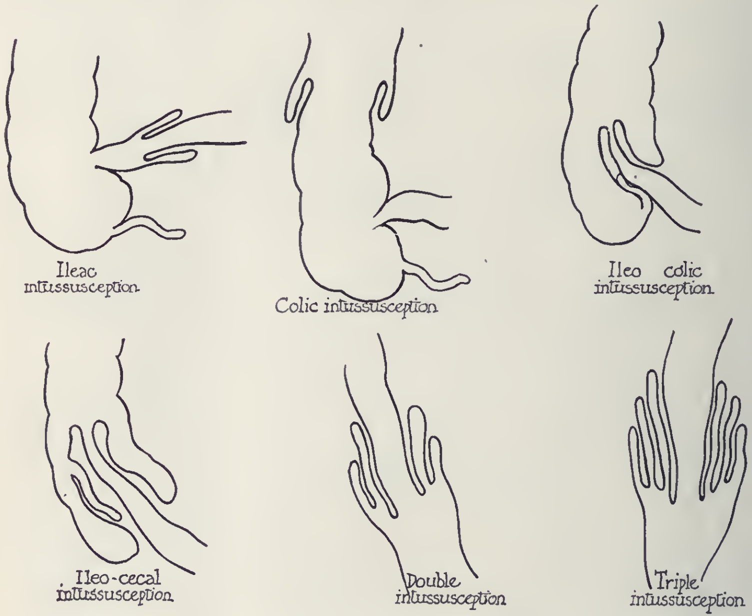

Fig. 451.—Diagram showing different types of intussusception.

The ileocecal type of intussusception occurs by far the most frequently, one author finding it in 89 per cent. of the cases and another in 82 per cent. Leichtenstern analyzed 180 cases and found the percentage of the different types in the various years to be as follows:

Variety.	Percentage under two years.	Percentage between two and five years.	Percentage between six and ten years.
Ileocecal	70	49	41
Ileac	6	13	38
Colic	19	25	21
Ileocolic	4	13	0

In a similar analysis of 380 cases Koch and Oerum found the following percentages:

Variety.	Percentage under one year.	Percentage over one year.
Ileocecal	49.5	38.0
Ileac	2.6	9.2
Colic	12.0	23.7
Ileocolic	3.5	1.3
Mixed	3.9	1.9
Undetermined[1]	28.0	25 7

In the typical acute cases the diagnosis is generally made without much difficulty. The two factors to be considered are sudden onset, intermittent pain of very great severity, vomiting, tumor mass which is most often felt in the rectum and along the course of the colon, bloody stools, constipation, and great prostration. In 22 out of 188 cases Holt found the tumor mass to be protruding from the anus.

In rare instances the cure of intussusception has been known to have occurred spontaneously by sloughing of the invaginated portion, the continuity of the intestine being preserved, as in a case of Dr. A. E. Halstead's. Kelley tells some curious methods of reduction formerly in vogue, but which have now become obsolete, placing quick silver in the bowel with the patient inverted and inflating the sheep's colon which had been introduced into the child's colon, were tried. A very few early cases may yield to abdominal taxis. There are enthusiastic advocates of attempting reduction by forcing air and water into the rectum. Three to five pounds to the square inch (water bag 7½ feet to 12½ feet above the patient) for twenty-five to thirty minutes has been recommended. Modern opinion is tending more and more to the idea that immediate surgical intervention is the best treatment for intussusception. Gibson analyzed 187 operative cases in regard to the mortality with reference to the age of the case. He found that if operation took place on the first day of the disease the mortality was 37 per cent.; on the second day, 39 per cent.; on the third day

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[1] Probably a large proportion of these were ileocecal.

61 per cent.; on the fourth day, 67 per cent.; on the fifth day, 73 per cent., and on the sixth day, 75 per cent. Kirmisson in analyzing 147 cases found the mortality to be only 14 per cent. when the operation was performed in the first twelve hours.

After laparotomy has been performed an attempt should be made to disinvaginate the intussusception by gently pressing or milking the intussusceptum upward without making traction on its free end. Damage to the wall of the gut should be repaired, as was done in the present case. The mesentery may be shortened if it is thought that by doing so a recurrence of the intussusception will be prevented.

Should disinvagination fail, the following procedures are to be considered:

1. Resection of the gut involved.
2. Excision of the intussusception by making a longitudinal incision in the intussuscipiens and cutting out the intussusceptum, and then sewing together the cut ends.
3. Coffey's operation, which consists essentially of excision of the intussusceptum, closure of the adjacent ends of the gut, and then the anastomosis of these segments.
4. K. Israel's operation, where the intussuscipiens is sutured to the parietal peritoneum before it is incised and the intussusceptum is then excised.
5. Ellsworth Eliot, Jr.'s operation, in which a soft-rubber catheter is passed through the canal of the intussusception, out through the opening in the uninjured gut, and out through the abdominal wall.
6. The segregation operation, where an anastomosis is established between the patent gut above and below the intussusception.
7. The production of an artificial anus in cases of severe shock, leaving the intussusception inside the abdomen.

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PYLEPHLEBITIS OF APPENDICAL ORIGIN SIMULATING LUNG ABSCESS

(Reported by Dr. Frederick Christopher)

Summary: Pylephlebitis of appendical origin simulating lung abscess in a patient who had influenzal pneumonia three weeks before admission to the hospital. Diagnosis revealed at autopsy. Review of the literature.

Mr. A. F., No. 136,205, entered St. Luke's Hospital on January 31, 1920 on a stretcher. The patient complained of chills and sweats of about one week's duration. He had had influenzal pneumonia three weeks before entrance, with chills, fever, hematopsis, and dyspnea. There had been pneumonia first on the right side and then on the left, with the crisis two weeks after the onset. During the week which followed the crisis and preceded the patient's entrance into St. Luke's Hospital there had been a series of seven or eight chills with sweating. *There were no complaints other than chills and sweats on entrance.*

On admission the physical findings were drowsiness, pupils contracted and not reacting to light (due to morphin received before entering the hospital), scleræ yellow, throat red and dry, râles in the back portion of the lower lobe of the right lung. The diagnosis of lung abscess in the back part of the right lower lung was made. *x*-Ray examination on January 31st showed a large mass in the upper right quadrant of the abdomen, which had the shape of the kidney, although it was very high, extending up to the twelfth dorsal vertebra. There was marked peribronchial thickening on both sides, especially on the right. The right diaphragm was high. The right costophrenic angle was unusually clear. Both apices were hazy. There was a marked amount of thickening along both upper lobes. There was evidence of an old process in the right base following a pneumonia, which gave the impression of a partly collapsed lung with a large amount of thickening of the pleura. Summary: Partially collapsed lung with a large amount of adhesions and some fluid in the base.

Repeated exploratory punctures of the right base were negative. On February 3d an abdominal incision was made and the gall-bladder was revealed, which was somewhat whiter than normal, and this was drained. Exploratory punctures were negative until February 21st, when 40 ounces of straw-colored translucent fluid were aspirated from the left pleural sac. There was at this time a small amount of edema of the legs, ankles, and tissues on the sternum. On February 22d there was a positive Kernig sign, with some rigidity of the neck. The patient was given plenty of water and a soft diet. At

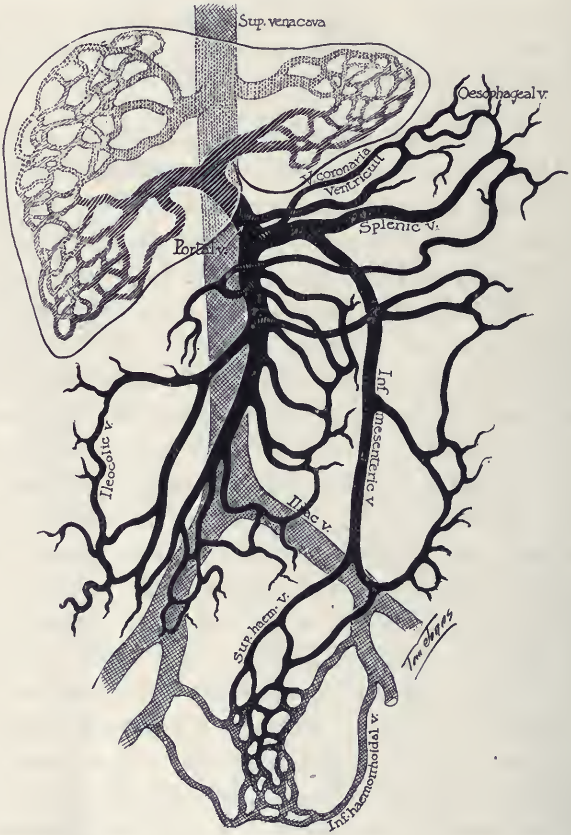

Fig. 452.—Diagrammatic sketch of normal portal circulation.

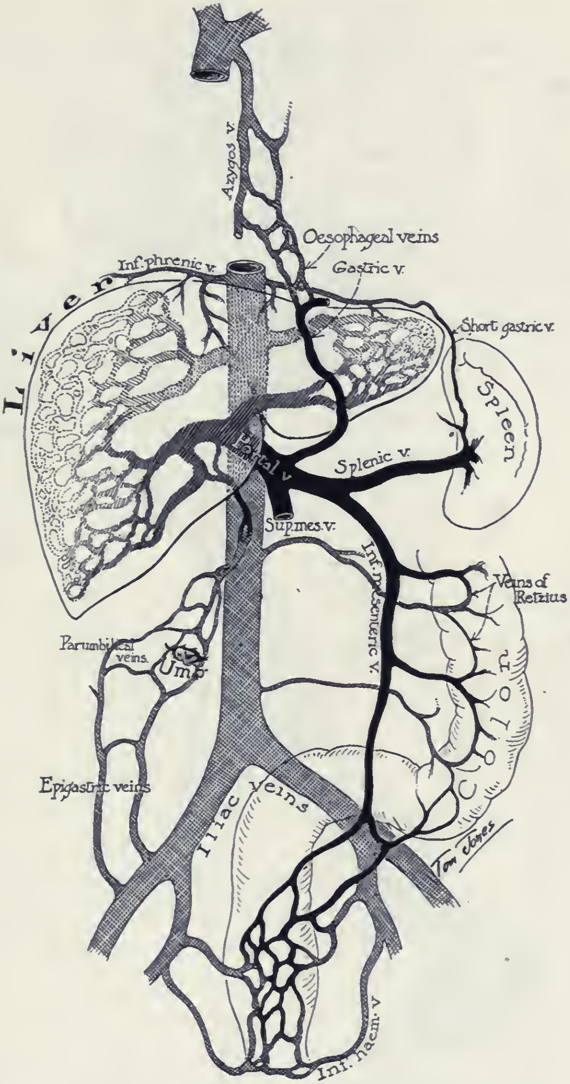

Fig. 453.—Diagrammatic sketch showing the different routes of the collateral portal circulation.

the beginning of each chill morphin sulphate, gr. $\frac{1}{4}$, atropin sulphate, gr. $\frac{1}{50}$, were given hypodermically. Pituitrin, one ampule hypodermically, and digifolin, $\frac{1}{2}$ to 1 ampule hypo-

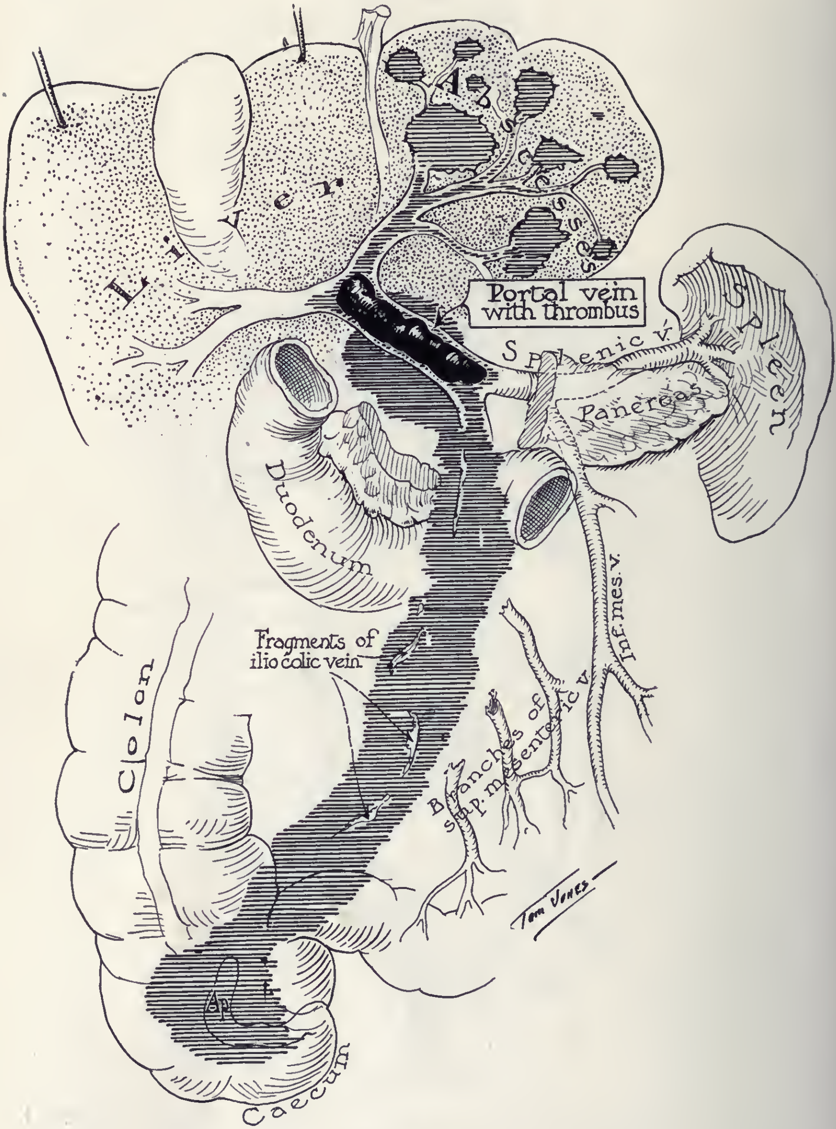
Liver
Abscesses
Portal vein with thrombus
Splenic v.
Spleen
Pancreas
Duodenum
Inf. mes. v.
Fragments of ilio colic vein
Branches of sup. mesenteric v.
Colon
Ap
Caecum

Fig. 454.—Diagrammatic sketch illustrating case reported. The path of the abscess is shown extending from the region of the appendix to the portal vein.

dermically or intravenously, were given from time to time. Camphorated oil, 1 to 4 grains hypodermically, and caffein sodium benzoate, grains 2, were also given. Various enemas were administered. Intravenous injections of saline were given toward the end, and sponge-baths to reduce the fever.

The fluid which had been aspirated from the left pleural cavity had a specific gravity of 1010 and on culture showed staphylococcus. The blood-cultures were negative. The urine contained a trace of albumin, few hyaline and granular casts, a few epithelial and white cells, and an occasional erythrocyte. The white blood count was about 15,000. On January 31st the red count was 3,460,000 and the hemoglobin was 67 per cent. On March 3d the red count was 2,440,000, the hemoglobin 55 per cent. There was anisocytosis, poikilocytosis, and polychromatophilia. On February 14th three normoblasts and 1 megaloblast were seen. There was a remittent fever ranging from 100° to 106.4° F., with two daily variations of 3 to 5 degrees. The pulse varied similarly, between 90 and 160. After February 16th there was only one daily remission of 1.5 degrees, the pulse varying between 120 and 150. The patient was very restless and irrational a good part of the time. On February 20th his right hand and left foot were placed under restraint. Beginning February 21st the patient began to be incontinent and had involuntary defecations. The pulse at the same time became very irregular. The patient died on March 12, 1920, after forty-one days in the hospital.

Necropsy was performed by Dr. Edwin F. Hirsch on March 12, 1920. The record was written, and certain details of direction were worked out by Dr. A. J. Peterson. The following is an abstract of the protocol:

"The subcutaneous fat of the midline of the trunk in front is yellow, lobulated, and at the level of the umbilicus 1.5 cm. thick. The skeletal muscles are pale pink. Opposite the umbilicus on the peritoneal surface is an infarcted tag of fat, 2.5 x 0.6 cm., attached by a base 0.5 cm. in diameter. In the peritoneal cavity there is about 500 c.c. of yellow, slightly turbid fluid. The opening opposite the surgically incised wound extends to the peritoneal surface on the inner side of an opening 1.5 cm. in diameter. The omentum covers the upper part of the bowel in front, is lobulated with yellow fat. The loops of small bowel are everywhere very moist. Upon lifting up the cecum the slight tension of the tissues at this place permits of the escape of yellow exudate slightly toward the midline. At this place there is marked necrosis and blackening of the tissues, the details of which will be given later. On the left side there is an intersigmoid fossa admitting easily the distal half of the index-finger. On the left side the mesosigmoid where it arches over the brim of the pelvis is adherent by several band-like fibrous adhesions. The inguinal and femoral rings are closed. The spleen is moderately increased in size. In the midline 4 cm. below the xiphoid on making the usual midline incision into the abdomen there is exposed an abscess with a necrotic wall having an opening 1.5 to 2 cm. in diameter, leading down to an abscess in the left lobe of the liver. In the region of the gall-bladder there are firm fibrous adhesions between the transverse mesocolon, the transverse colon, the pylorus of the stomach, and the parietal peritoneum opposite this place.

"The costal cartilage cut easily. On the right side the pleural cavity is partially obliterated by firm fibrous adhesions. On the left side the lung is somewhat flattened and the pleural cavity contains about a liter of slightly turbid, yellow liquid. The pericardial sac is hyperemic and covered with a little thin layer of fibrin. The sac contains about 150 c.c. of very yellow, clear fluid. The body is eviscerated in the usual manner and the organs of the chest and abdomen examined from behind. The lining of the aorta is roughened moderately by many slightly raised circular and linear areas of fatty change, especially about the vessels of the celiac axis and abdominal part of the aorta. There is moderate postmortem digestion of the lining of the esophagus. The lining of the trachea and main bronchi is reddened, and the mucous lining of the main bronchus of the left lung contains numerous small petechial hemorrhages; there is a little frothy fluid on the lining of these membranes.

"On the anterior surface of the apex of the heart there is a tag of partly organized fibrin adherent by a base of about 9.5 cm. area; this tag of fibrin is 1 x 0.8 cm. and 2 cm. thick. There is a moderate amount of subpericardial adipose tissue. The leaflets of the tricuspid valve are not changed particularly. On the anterior mitral leaflet there are patches of fibrous tissue; there are similar ones on the posterior, but not so extensive. In the left chamber of the heart there is a fibrous band 2 millimeters in thickness, which on slight tension is 2.7 cm. long, and extends across from the base of the papillary muscle of the anterior leaflet to the septum. The root of the aorta is toughened slightly by yellow circular and linear areas of 1 mm. width and 2 mm. diameter of fatty infiltration. There are no changes in the leaflets of the aortic valve. The mouths of the coronary arteries are patent. On the right side there are the mouths of three accessory coronary arteries in addition to the usual one. The myocardium is pale red and rather soft and presents a moderate degree of cloudy swelling. There are no alterations in the superior and inferior vena cava. At the site of the old eustachian valve there is a broad, loosely meshed membrane which with slight tension is 3.5 cm. at its broadest dimension and 7 cm. wide.

"The posterior part of the right lung is somewhat firmer than anteriorly and is boggy. On surfaces made by sectioning the organ a large quantity of frothy, blood-stained fluid escapes. The tissues are somewhat firmer than normal, but without glandular surfaces. The left lung is compressed somewhat. On the outer surface of the left lung there is a thin fibrinous exudate, limited chiefly to the lower lobe. The peribronchial lymph-nodes are not especially enlarged, and are black with coal-dust pigmentation.

"There is marked loss of the yellow substance of the adrenal cortices.

"The perirenal adipose tissue is fairly abundant. There is slight tension of the kidney tissues underneath the capsule. The cortical striations are somewhat diminished, the parenchyma of the organ distinctly yellow. There are no changes in the right ureter. The capsule of the kidney strips easily, leaving a smooth, slightly yellow, injected surface. The left kidney is slightly larger than the right. There are no changes in the left ureter. The description of the left kidney in general corresponds with that of the right. The capsule strips easily, leaving a perfectly smooth surface. The right kidney weighs 170 gm.; the left, 200.

"The biliary lymph-glands are markedly increased in size. There are no changes in the common bile-duct. The portal vein is completely obstructed by an infected thrombus, which is yellow and contains an exudate 9.5 x 2 cm. It extends down as far as and into the splenic vein a distance of 1.5 cm.

"The appendix lies medially and behind the cecum; it is over all 10 cm. long, the distal 7 of which is distended to a width on the average of 1.8 cm. This part of the appendix is bound down by organizing fibrinous and rather firm, fibrous adhesions. To the midline there is a greenish discoloration of the tissues over an area of 3.5 cm. diameter; there is also in the mesentery of the small bowel a greenish discoloration of the fat. The mesenteric lymph-glands are moderately increased in size.

"The spleen is 16 cm. long, 10 wide, and 6 think; there are multiple septic infarcts, one having ruptured to the surface in removal, as large as 2 x 1.3 cm., the others smaller. The spleen weighs 255 gm.

"The ramifications of the portal vein in the liver are filled with yellow pus, and in the left lobe of the liver there are multiple abscesses, one of them 4 x 2 cm., that contains a slightly brown and yellow exudate. It is estimated that there are probably ten to twelve such abscesses. The liver weighs 1844 gm. The gall-bladder is adherent by fibrous tissue, as indicated in the preceding part of the record; its lining is reddened moderately, but quite velvety and smooth.

"The portal vein is apparently completely obstructed by an infected thrombus, which is yellow and red. This thrombus extends into the liver portion of the portal vein, and as far down as the splenic vein. The lining of the splenic vein is smooth and unchanged; the same is true of the lining of the inferior mesenteric vein, which is opened as far as its finer ramifications. The lining of what is apparently the right colic vein is pitted and eroded; its proximal end is completely destroyed, so that it opens into a large abscess, 3 to 4 cm. in diameter, of reddish necrotic material, which is immediately below the portal vein, where the splenic vein joins it. It is possible to trace this vessel distally for 9 to 10 cm. only. What is apparently an intestinal vein can be traced from the abscess mentioned to the cut edge of the mesentery of the small bowel, where, by the way of a small anastomosing branch, another intestinal vein is followed back to the abscess. The linings of these intestinal veins are smooth and unchanged except in their proximal 3 to 4 cm., where they are blackish green and yellow. No connection can be made out between the right colic vein or the two intestinal veins described and the portal vein. There is no trace of the main branch of the superior mesenteric vein.

"The vermiform appendix is retrocecal and points medially; it is about 10 cm. long and 1.8 cm. wide. It is bound down by firm fibrous adhesions. It is blackish green and gangrenous except for the proximal 1 cm., which is pink. The appendix is opened lengthwise, and a large amount of yellow pus runs out. The appendix is blackish green throughout its entire thickness; its lining is pitted and eroded. There is an opening 3 to 4 mm. in diameter on its front wall 1.5 cm. from its distal end. A probe inserted through this hole passes into a retrocecal cavity filled with yellow purulent material, which oozes through the opening. This cavity is about 3 cm. in diameter, lined with blackish-green necrotic material, and lies rather in front of the appendix. The cavity is continuous with an abscess, similarly lined and containing yellow purulent material, 1.5 to 4 cm. in diameter, which extends rather directly upward through the root of the mesentery of the small bowel to the abscess already described, which lies between the pancreas and the duodenum and below the portal vein, where the splenic vein joins it. This abscess which runs through the root of the mesentery of the small bowel and slightly to the right of it apparently occupies the site of the superior mesenteric vein and its ileocolic branch. This abscess extends up between the pancreas and the duodenum to the greater curvature of the stomach, where it produces an ulcer-like thinning of the serosa wall of the pyloric antrum in an area 6 mm. in diameter.

"A thrombus, worm-like in shape, 1 cm. long and 0.2 in diameter, colored red, brown, and yellow in transverse layers, is in a vein in the tissues between the bladder and the rectum; this vessel cannot be identified.

"The portal vein is apparently completely obstructed by an infected thrombus in the first 2 to 3 cm. of its intrahepatic portion. The capsule of the liver is smooth and pink. There are five to six green patches, 2 to 4 cm. in diameter, on the front part of the upper surface of the left lobe of the liver. Two of these are ruptured and lead by openings of 1 to 1.5 cm. diameter to cavities containing yellow purulent material. The front half of the lower surface of the left lobe contains three to four yellow spots, 0.5 to 2 cm. in diameter. There is a ruptured abscess, about 2 cm. in diameter, in the surface of the liver and just to the right of the tip of the gall-bladder. The branch of the portal vein to the left lobe of the liver leads to multiple abscesses; it is difficult to make out any venous wall beyond the thrombus described above, as all is a mass of yellow and green pus. The branch of the portal vein to the right lobe is also filled with yellow and green pus, but there are no abscesses present. Yet it is possible to express a greenish-yellow pus from the finer ramifications of the portal vein in this lobe on the sectioned surface. On surfaces made by sectioning the liver the centers of the lobules are bright red, the peripheries distinctly yellow.

"The lining of the stomach is smooth and is moderately hyperemic in its lower portion. There are no changes in the lining of the urinary bladder, prostate, seminal vesicles, rectum, or colon.

"There is hyperemia of the lining of the upper portion of the small bowel.

"There are no changes in either submaxillary gland. There are no changes in the right internal jugular vein; the same is true of the left one. There is a little fatty infiltration in the lining of the common carotid arteries. The left tonsil is small, and contains only a small amount of lymphoid tissue; the same is true of the right. The muscle of the tongue is pale pink. There are no changes in the upper portion of the pharynx or larynx. The laryngeal cartilage is ossified. The tissues of the thyroid gland are unchanged.

"**Bacteriology.**—Cultures of the heart's blood, abscesses of the spleen, and left pleural fluid contained chiefly Staphylococcus albus. While those from the portal thrombus and liver abscesses were mixed, the predominant organism was also a Staphylococcus albus.

"**Anatomic Diagnosis.**—Multiple abscesses of left lobe of liver; suppurative pylephlebitis of branches of portal vein in liver; suppurative phlebitis of superior mesenteric vein and its colic and ileocolic branches; septic thrombosis of the portal vein with extension into the splenic vein (complete obstruction of portal vein); suppurative gangrenous appendicitis with perforation into an abscess of the root of the mesentery; retrocecal abscess; acute generalized serous peritonitis; left serofibrinous pleuritis; fibrinous epicardial patch; multiple septic infarcts of the spleen; lessened yellow material of adrenal cortices; marked hyperplasia of the biliary lymph-glands; moderate hyperplasia of the mesenteric lymph-glands; abscess erosion of the serosa of the pyloric antrum of the stomach; infarcted subperitoneal lobule of fat opposite the umbilicus; thrombosis of one of the branches of the hemorrhoidal veins; edema of the ankles; hypodermic needle puncture wounds of the right arm; disappearing hypodermic needle puncture wounds of the left arm; hydropericardium; cloudy swelling of the myocardium; hypostatic hyperemia and edema of the lungs; hyperemia and fatty change of the liver; cloudy swelling and fatty changes of the kidneys; moderate hyperplasia of the spleen; hyperemia of the lining of the upper portion of the small bowel; hyperemia of the lining of the lower portion of the rectum; hyperemia of the lining of the gall-bladder; hyperemia of the lining of the trachea and main branch; small petechial hemorrhages of the lining of the main bronchus of the left lung; slight hyperplasia and coal-dust pigmentation of the peribronchial lymph-glands; fibrinous and fibrous adhesions between the appendix and the cecum; frothy fluid in the trachea and bronchi; hyperemia of the tissues about the umbilicus; healing surgical wound of the right epigastrium; beginning sacral bed-sores; decubitus ulcers of the skin of the trochanters; slight sclerosis of the mitral leaflets; moderate sclerosis and fatty change of the lining of the aorta; slight fatty infiltration of the lining of the common carotid artery; right fibrous pleuritis; partial compression of the left lung; fibrous adhesions between the gall-bladder and the transverse mesocolon, transverse colon, pylorus of the stomach, and parietal peritoneum; fibrous adhesions between the mesosigmoid and the brim of the pelvis; atrophic tonsils; ossification of the laryngeal cartilages; long absent teeth; vaccination scars of the right upper arm; scar of the right chest; superficial scars about the left knee; callosities of the toes; scar of the left great toe; disappearing hemorrhage of the left fourth toe; false upper teeth; impacted cerumen; surgical dressings; pedunculated verruca of the base of the penis; loss of pigment of the skin of the forearms, thighs, and legs; patent intersigmoid fossa; retrocecal appendix; accessory coronary arteries; accessory chorda tendineæ of the left heart chamber; membranous persistent eustachian valve; moderate postmortem digestion of the lining of the esophagus; postmortem digestion of the lining of the stomach; postmortem discoloration of the mesentery of the small bowel."

Appendicitis has long been recognized to be a cause of pylephlebitis and hepatic abscesses, but there is considerable difference of opinion as to the frequency with which this grave sequel occurs. The first description of a case in which perityphlitic inflammation was followed by pus in the portal vein and liver abscesses is attributed by Loisson to Waller in 1846. Ochsner scarcely mentions metastatic abscesses of the liver after appendicitis. Gerster found it 9 times in 1187 cases of appendicitis operated on at the Mount Sinai Hospital in the course of ten years. Fitz found suppurating pylephlebitis in 11 cases of 257 cases of suppurating appendicitis, and in 2714 clinical cases of appendicitis collected from the various London hospitals there were 10 cases of suppurative pylephlebitis, 0.4 per cent. Gibson found only 1 case of multiple abscess of the liver in 782 operations for acute appendicitis. Langdon Brown reported 12 cases out of 9494 necropsies, or 0.12 per cent. Munro reported 9 cases of portal vein infection following appendicitis, and goes so far as to say that hepatic abscesses occur in 5 to 10 per cent. of the cases of appendicitis. While pylephlebitis with multiple abscesses of the liver or lung is a very grave complication of appendicitis, numerous cases with recovery have been reported (Hellström, Kelley, Scott, Barlow, and Brugemann). Brogden reports a case with recovery after operation on the liver. This circumstance leads one to the conclusion that perhaps many cases which are never recognized recover. Bryant, in necropsies on 20 cases of pylephlebitis at Guy's Hospital, found that in only 2 instances had the correct diagnosis been made during life. Of course, not all cases of hepatic abscess are due to appendicitis. Hart says that in 17 cases of liver abscess in which the infection was through the portal vein, occurring at the Presbyterian Hospital, New York, 3 were found to have origin in the appendix. When one considers the anatomic proximity of the appendix and the liver, it is to be wondered that liver abscesses and pylephlebitis are not more frequent. The appendical veins empty into the ileocolic vein, the latter into the right colic vein, and that into the superior mesenteric vein, which, in turn, empties into the portal vein. This anatomic arrangement makes it practically certain that septic emboli from the appendix will lodge in the portal vein or the liver. It is generally thought that pylephlebitis may originate from appendicitis by: 1, continued thrombosis; 2, septic emboli, which may be detached by (*a*) lack of firm adhesion of the thrombus to the walls of the vessels; (*b*) loss of consistence of the thrombus due to septic deliquescence; (*c*) mechanical factors acting from within or without the body (manipulations of a surgical operation, etc.). Other veins than the portal may be involved and the septic material may be carried as far as the lung. Gerster says, "Large emboli may pass directly through the substance of the liver by means of large venous anastomoses existing, according to Claude Bernard, between the portal vein and the vena cava." I cannot find confirmation of this mechanism of transportation of emboli to the lung. There is the possibility that septic material could pass to the caval circulation by other routes. Piersol gives the collateral circulation of the liver as follows:

1. Gastric vein to esophageal veins, to azygos veins and hemiazygos veins.
2. Hemorrhoidal veins to the hemorrhoidal plexus, to the hemorrhoidal branches of the internal iliac.
3. Umbilial veins to supra-umbilical veins, and to superior and deep epigastric veins, and so to the external iliac vein.
4. Veins of the falsiform ligament to the phrenic veins.
5. Retroperitoneal anastomoses between peritoneal and mesenteric veins (veins of Retzius).

That the retroperitoneal lymphatics constitute another route of communication between the appendix and the liver was emphasized very ably by Monro in his paper before the Chicago Surgical Society in 1905. He says that lymphatic paths extend along the retroperitoneal space to the liver, diaphragm, and thoracic regions. Furthermore, there is a connection between the lymphatics of the diaphragm and those of the peritoneum, thus enabling infected material absorbed from the abdomen to enter the diaphragmatic lymphatics. He believes portal infection to be the commonest cause of intrahepatic abscess, but a lymphangitis may be coexistent. Some Europeans believe that liver and lung complications are far more frequent in cases which run for some time unrecognized or without operation. And it has been thought that infection of the portal vein is more liable to occur when an abscess has formed around the appendix and the pus is under pressure. The non-inversion operation for appendicitis has been mentioned as a dangerous factor. The condition may occur where the appendix has not ruptured, and it has even been considered possible that so slight a disorder as chronic obliterative appendicitis may result in fatal pylephlebitis.

Munro's conclusions are worthy of very thoughtful consideration. They are as follows:

1. Lymphatic and hepatic infections are more common than we believe.

2. The two infections are frequently associated, and one type may be the source of origin of the other.

3. In certain cases of hepatic abscess the source of infection, whether through the portal canals or through the lymphatics, cannot be determined either clinically or at operation.

4. The type of infection does not depend upon the gravity of the originating appendicitis.

5. Subphrenic infections must not be isolated in a class by themselves, as they depend on both lymphatic and hepatic infections, and vice versa.

6. Hepatic infections are not uniformly distributed even when originating in the portal tract, the left lobe being solely affected at times.

7. The prognosis of lymphatic (including subphrenic) infections is better than that of hepatic, but when the latter are secondary to the lymphatics or direct mechanical invasion, the outlook is more favorable than in the true portal invasions.

8. The most important clew in making a diagnosis is the recognition of a causative appendicitis, and the elimination of this possible cause is necessary in dealing with obscure hepatic invasions in the presence of plasmodia, Widal reaction, etc.

While the differential diagnosis may be very difficult, perhaps the most important single symptom to be considered is the presence of chills followed by high temperature. The chills may exist before the operation and even before the development of the physical signs of appendicitis (five days before in Blatchly's case—Curtis) and may vary very greatly in number and intensity. They may occur several times a day, the thermometer showing steep curves of relatively high rises and subnormal falls, and then they may stop a day or two. The temperature curve contrasts rather markedly with the typhoidal or ordinary septic curves. Icterus is variable. Urobilin in the urine and diarrhea have been mentioned, and one author believes a striking feature to be the absence of the coated tongue.

As early as 1882 Chvostek called attention to the possibility of confusing pylephlebitis with such thoracic conditions as pneumonia, empyema, and subdiaphragmatic abscess. Munro says that "from the pneumonia or empyema, especially if ushered in with abdominal spasm, the distinction must be difficult and at times impossible." Occasionally friction-rubs are heard over the dome of the liver due to the rubbing together of inflamed peritoneal surfaces. Or these may be audible over the right side of the chest from extension of inflammation through the diaphragm to the pleura. Pressure exerted by the enlarged liver may lead to bulging of the chest wall and to collapse of the lung, simulating pleurisy with effusion. In some cases there may actually be a purulent effusion into the pleura and the lung may contain abscesses. It is not to be wondered at that such cases may be diagnosed as empyema or septic pneumonia. In pylephlebitis there may be collapse and hypostatic congestion of the base of the lung. Abscesses with surrounding pneumonia complications may not be infrequent in neglected cases of appendicitis, and can be due to direct extension through the diaphragm or, in rare instances, to general pyemia, some pylephlebitic abscesses having discharged into hepatic veins. Hall presents 14 interesting cases; his first is a lung abscess. In his third case the symptoms of appendicitis were so slight that little heed was given them until the appearance of a lung abscess eight weeks later. His fourth case developed even a pericarditis. The second case of Babler's series is very interesting. Twenty-four days after operation there was pain in the right chest and three days later pus was aspirated. Although aspiration of the abscess gave temporary relief, it finally ruptured into a bronchus and death ensued.

While surgical intervention offers some hope in cases of isolated liver abscesses, that is about the limit of its usefulness. Mention might be made of a case cured by Barlow after the use of eusol intravenously.

The feature of outstanding interest in the present case is that upon admission the physical signs and symptoms pointed to the lung, and neither history nor physical examination indicated that the chief source of trouble was in the abdomen. There was history of having had influenzal pneumonia three weeks before entrance, with the crisis two weeks after the onset, which was one week before the admission to the hospital. There is nothing in the autopsy findings which would contradict this history, although the condition of the lungs showed there could have been no preceding lobar pneumonia in that length of time. The exact time of onset of the appendicitis can only be a matter of conjecture, but it seems very probable that it was *during* the pneumonia attack and before its crisis. The symptoms of pneumonia probably so masked those of the appendicitis that the latter were overlooked. The fact that in the week following the crisis there were seven or eight chills with sweating further points to this conclusion by suggesting that the pylephlebitis, which was of appendical origin, already had occurred. The presence of lung signs may readily be explained as a residue of the preceding pneumonia, superimposed upon which were the changes in the pleural cavity brought about by extension of the infectious processes through the diaphragm from the liver.

The writer desires to thank Dr. Halstead for permission to report this case.

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CLINIC OF DR. DAVID C. STRAUS

Cook County Hospital

AMPUTATION OF THE THIGH WITH DEMONSTRATION OF 3 CASES PRESENTING UNCOMMON INDICATIONS FOR ITS PERFORMANCE[1]

Summary: Demonstration of a case of mal perforant du pied (perforating ulcer of the foot) due to a peripheral nerve lesion; a case of tuberculosis of the knee-joint of thirty-three years' duration in a man of forty-five; and a case of painful stump due to an osteophyte following an old thigh amputation, with an analysis of these cases. Discussion of the technic of amputation of the thigh and some points in the after-treatment.

This morning I wish to consider the subject of amputation of the thigh and present 3 cases that I have amputated within the last few weeks. All three amputations were done for conditions which do not ordinarily require such radical treatment.

The *first case* is one of *mal perforant du pied* (*perforating ulcer of the foot*). The patient, who is twenty-seven years of age, has been in the hospital on two previous occasions because of an ulcer beneath his left heel, and it was for this same condition that he returned this time. To fully understand the case it is necessary to go over his history from the time of an accident which occurred to him during his childhood. The history is unusually interesting and instructive.

He had no trouble with either leg until he was eight years of age, when, while running across a field one day, he suddenly slipped and fell on some sharp object, sustaining a cut across the front of the right knee. There was a curved cut transversely across the front of the knee, just below the joint (Fig. 455). The skin was loose in a flap that could be lifted upward. The leg bled very freely, but he was able to run home. This occurred in Manchester, England, and he was at once taken to the Royal Infirmary. The wound was probed in an effort to find any glass or other foreign material, but nothing was found. He remained at the Infirmary for observation. Some days later a transverse incision was made on the outer posterior aspect of the knee. After a few days more four additional incisions were made, a pair just above the patella, one on the anterolateral and one on the anteromedial surface of the thigh, and a second similar pair

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[1] These cases were shown at the Clinical Meeting of the Chicago Surgical Society held January 7, 1921.

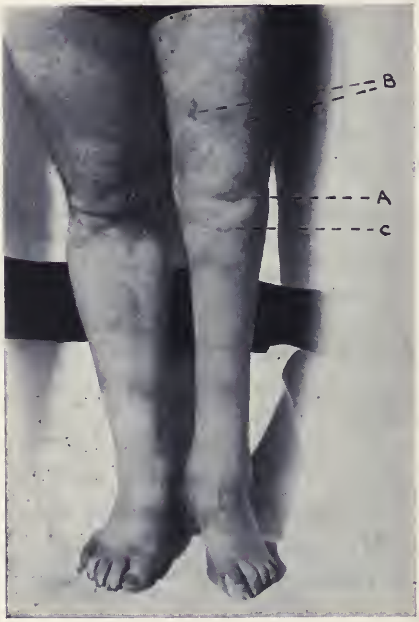

Fig. 455.—Photograph of both legs from in front (Case I). Note that the left leg is considerably shorter than the right and that the left foot is considerably smaller than the right. Note also the enlargement about the left ankle due to the arthropathy. The scar from the original injury is seen at *A*. The two scars (*B*) above the knee-joint show the site of the lower transverse drainage-tube. *C* is the scar from the operation subsequently performed to straighten the knee, a resection of the knee-joint. Following this, due to division of peripheral nerves during this operation, the trophic changes resulted, the most important among these being the mal perforant du pied. This photograph was taken when the patient was in the hospital in July, 1920.

higher up on the thigh. A rubber drainage-tube was passed through each pair of incisions. He remained in the hospital for six months and then returned to his home. After leaving the hospital he had pain on weight bearing. Contracture of the knee-joint gradually developed. This progressively increased, until finally the knee was held flexed at about a right angle. Later the pain was present only at times. This was the condition of the limb on his arrival in America when he was fourteen years old. On his arrival here he went to a hospital at Buffalo, New York, to have the leg straightened. A typical resection of the knee-joint was performed and a plaster cast was applied from the ankle to the hip. Immediately following the operation he noticed that he had no sensation below his ankle and no control of the foot. The cast remained on for five months. During the first three months he was kept in bed, and during this time his foot was allowed to hang extended plantarward without any support. As a result a bed-sore developed on the plantar surface of the heel where the heel rested on the bed. From this history it is perfectly obvious that extensive destruction of the peripheral nerves occurred during this knee-joint resection, with a resulting typical drop-foot. The bed-sore healed as soon as he got up from the bed. At this time he noticed that he could not put the heel on the ground, due to contracture of the tendo achillis. To remedy this, tenotomy of the tendo achillis was performed. Following the tenotomy he was able to put his heel on the ground, but he had no control of the foot. Two months later, five months after the first operation, he was discharged from the hospital. The knee was ankylosed in extension, he had no control of the ankle, and there was anesthesia of the entire leg and foot except on the inner side of the leg from the knee to the ankle.

The condition remained unchanged for about eight years, when an ulcer developed on the heel at the site of the old bedsore. The ulcer was about the size of a 50-cent piece, and he said he could put his finger into it and "it did not hurt a bit." A physician cut away all the necrotic tissue, and it was three months before the ulcer was healed. This ulcer never recurred.

About four years later he developed an extensive infection of the left little toe and half of the outer side of the foot. This healed after one month and remained healed. In March, 1919 he developed an ulcer under the left heel. It was for this that he came to the Cook County Hospital the first time. The hospital record shows that he had a typical trophic ulcer of the heel. After remaining in bed a week and a half the ulcer healed and he was discharged. About three months later the ulcer recurred, but as it caused him no pain he allowed it to go untreated until July, 1920, when he again returned to the County Hospital, this time on my service. Examination on admission showed the following:

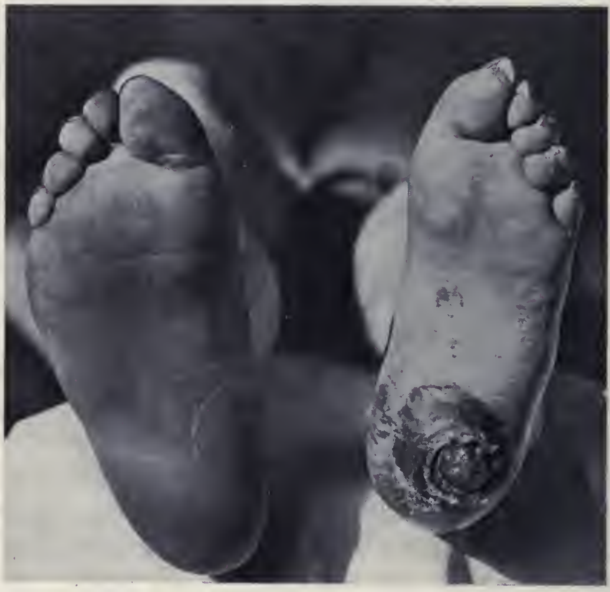

Fig. 456.—Photograph of both feet, plantar view (Case I). Note that the left foot is considerably smaller than the right and shows the perforating ulcer below the heel. Note the hyperkeratosis of the skin about the ulcer crater, producing the elevated and thickened margin. Note also the trophic changes of the nails, which are greatly thickened, more curved than normal in both diameters, as compared with those of the other foot, and misshapen. The skin shows other evidence of trophic change, as the callus noted beneath the great toe and beneath the anterior portion of the foot.

The left knee-joint was ankylosed and painless and the leg below the knee was greatly shortened and showed marked atrophy (Fig. 455). The scars from the previous operations were plainly visible. The left foot was considerably smaller than the right and showed a perforating ulcer below the heel and other trophic changes, such as marked atrophy of the foot, marked trophic changes of the nails, which were greatly thickened and curved (Fig. 456), and total anesthesia of the sole of the foot. The ulcer beneath the heel was a typical perforating ulcer (Fig. 456). The ulcer crater was about the size of a 50-cent piece and extended deeply into the soft parts. The walls of the ulcer were very thick, and showed a marked hyperkeratosis of the skin. The ulcer was entirely anesthetic and a probe inserted into the crater reached to the os calcis, which similarly was devoid of sensation. There was some redness of the soft parts about the ulcer and the patient had a temperature of 103° F. A complete physical examination was entirely negative except for the local condition. In order to rule out the possibility of a luetic infection evidences of syphilis were particularly looked for, but none were found. A roentgenogram was ordered. I believed this temperature was probably due to the infection about the ulcer, and consequently had hot wet dressings applied.

The roentgenogram of the foot (Figs. 457, 458) showed the typical picture of an arthropathy. The lower end of the tibia and fibula showed definite sclerosis with new bone formation and osteophytes. The articular portion of the astragalus likewise showed an increased density with new bone deposit, so that the ankle-joint showed a definite widening of the articular surfaces. The picture was similar to that seen in a beginning arthropathy due to tabes, paresis, or syringomyelia. There is no particular difference in the roentgenologic appearance of the *arthropathy* that develops in any of these conditions, but the roentgenologic finding of an *increase in density* of the bone in these conditions is of definite value in differentiating these arthropathies from other conditions with which they may be confused. The most frequent condition of the ankle-joint that must be considered in differential diagnosis is *tuberculosis*, and here the characteristic roentgenologic finding is a *decrease in density* of the bones forming the joint. The lower surface of the os calcis showed a spur down to which the perforating ulcer reached, as is usual in these cases.

From the history of the anesthesia and the loss of control of the foot coming on immediately following the resection of the knee-joint, it was clear that these changes were due to a division of peripheral nerves at that operation. The bed-sore that developed while he was still in the hospital may have been for the most part a purely decubitus ulcer, though it was probably a combination of both pressure and trophic change. The ulcer that appeared later at the same site was probably purely

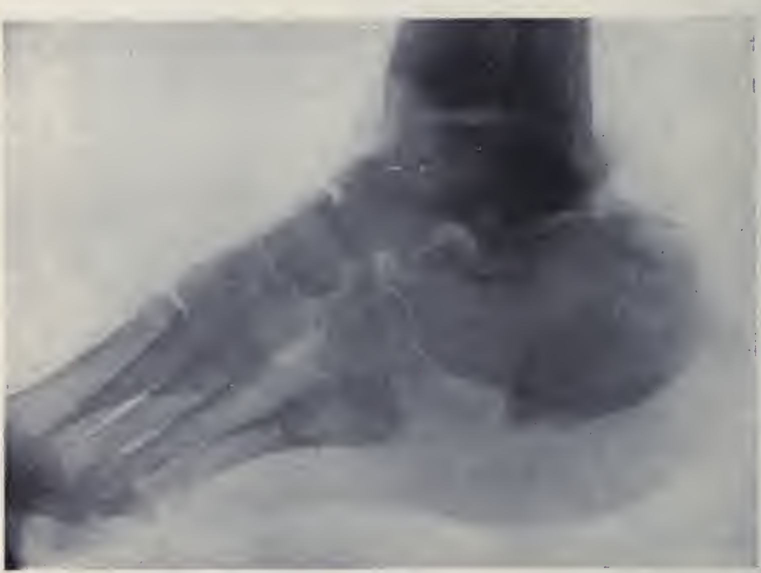

Fig. 457.—Roentgenogram of left foot, lateral view, taken while the patient was in the hospital during July, 1920. This shows the typical picture of an arthropathy. The lower end of the tibia and of the fibula show definite sclerosis, with new bone formation and osteophytes. The articular portion of the astragalus likewise shows an increased density with new bone deposit, so that the ankle-joint shows a definite widening of the articular surfaces. There is a spur on the lower surface of the os calcis, down to which the perforating ulcer reached, as is usual in these cases. The dorsal surface of the posterior portion of the os calcis shows osteophyte formation.

a trophic manifestation. The infection of the little toe and almost half of the foot probably began from an injury with a resulting infection, both of which were unnoticed because of the local anesthesia, and progressed to such a marked extent because of the poor nutrition due to trophic changes. Certainly the extensive destruction that resulted was related to the nerve lesion.

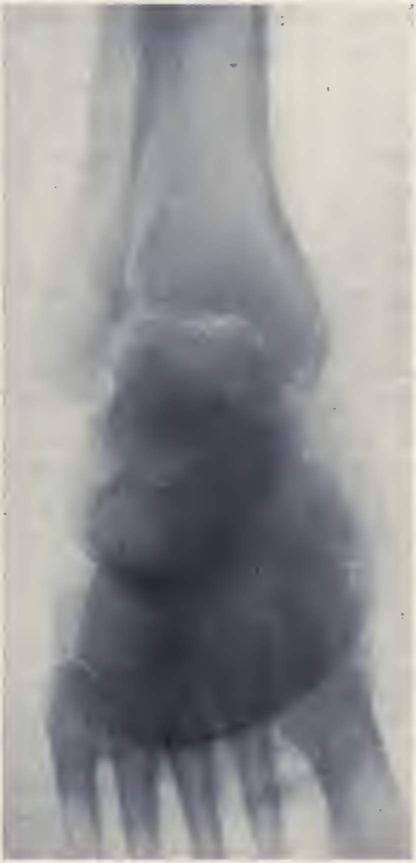

Fig. 458.—Roentgenogram of left foot and ankle, anteroposterior view, taken while the patient was in the hospital in July, 1920. This shows the arthropathy of the ankle-joint and, in addition, periosteal thickening of the opposing sides of the lower end of the tibia and of the fibula, due to previous infection from the perforating ulcer, with resulting cellulitis and periostitis.

Under local treatment with hot moist dressings and rest in bed the temperature returned to normal, but the ulcer refused to heal. Consequently, I decided to excise the ulcer and cut away the greatly thickened and sclerotic margins so as to improve the circulation and allow the ulcer to heal by granulation. This was done in the following manner:

Without the use of any anesthetic the greatly thickened margins of the ulcer were widely excised well into normal tissue, cutting through all the soft parts down to the os calcis. This left a defect about 7 cm. in diameter. The entire wound was swabbed with tincture of iodin. In order to close this the margins of the incision were widely undermined and then approximated as well as possible by means of interrupted silkworm-gut stitches placed transversely to the long axis of the foot. A considerable gap still remained. This was allowed to close by granulations. By July 8th the wound had completely filled in and the patient was discharged from the hospital in good condition, walking with the aid of crutches. Before leaving the hospital it was explained to him that the ulcer would probably recur, and that if it did he ought to consider allowing the leg to be amputated, as it would always be a source of inconvenience and danger to him.

Three weeks after leaving the hospital (July 29, 1920) while walking on the street one day he slipped and fell, hitting his heel on the pavement. The recent scar was torn open. He returned to the hospital the same night and was again admitted to my service. He was in great pain and had a temperature of 101° F. Hot moist dressings were again applied. Considering the fact that this rise in temperature followed within a few hours after the fall, it was perfectly obvious that it could not have been due to an infection developing at the time of the accident, but must have been due to the lighting up of infection that had been quiescent. Also his history showed there had been several previous similar flare-ups after trivial injuries to the leg. By the following morning his temperature had risen to 103.2° F. and by that night reached 104.6° F., due to a severe cellulitis of the foot, ankle, and lower leg, with a purulent arthritis of the ankle-joint. It was necessary to resort to multiple incisions to drain the soft parts and typical drainage of the ankle-joint. The temperature remained above 104° F. until August 1st. On August 1st it was 103.6° F., August 2d, 103.8° F., August 3d, the day of amputation, it was 102.4° F. at 3.34 A. M. As the pus continued to discharge freely and the temperature remained up, I decided to amputate.

In order to determine the amount of bone involvement and whether or not osteomyelitis of the tibia or fibula was present, a roentgenogram was ordered. The plate showed a total obliteration of the ankle-joint due to the old joint resection and the two wire loops that were inserted at that time to hold the femur and tibia in apposition. There was a marked deposit of new periosteal bone about the shafts of tibia and fibula for almost their entire length, a typical periosteitis, and in their lower 20 cm. this newly formed bone filled the entire interosseous space between the tibia and fibula. Above this there were irregular dense shadows suggesting sequestration or ossification. The ankle-joint showed marked bone damage due to the suppurative arthritis. The os calcis showed sclerotic changes typical of an osteo-arthropathy.

Operation.—Accordingly, on August 3, 1920 the leg was amputated. The amputation was made at the lower third of the femur, using a longer anterior flap and a shorter posterior flap. The amputation was so planned as to leave as much of the normal portion of the femur as possible and still cut the anterior flap so that its lower margin was definitely above the old drainage incisions, just above the patella, in order to make the amputation through as nearly normal tissue as possible. An aperiosteal amputation was performed. A consideration of the type of flaps to be cut, the location and length of the flaps, and the site at which the bone is divided and the treatment of nerves and vessels in any particular case will be discussed later. A rubber drainage-tube was inserted transversely across the lower angle of the stump.

Following the operation his highest temperature was 101.8° F., and after the fourth day it never reached 100° F.; it returned to normal a week after the operation and remained normal after that.

In order to obtain a painless stump the Hirsch method of after-treatment was employed. This will be discussed in detail when considering the technic and management of thigh amputations in general. The wound healed by primary union. The patient was walking about the ward on the tenth day after operation. He was discharged from the hospital on August 28th, with a good and painless stump (Fig. 459). He has gained greatly in weight and strength, and at present says he feels

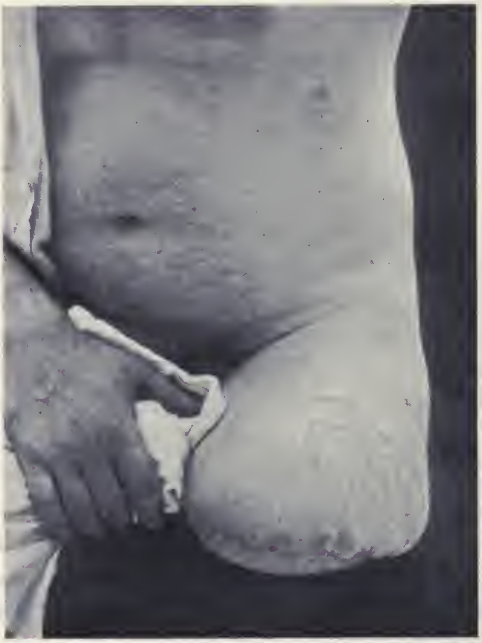

Fig. 459.—Photograph of amputation stump, Case I, taken shortly before his discharge from the hospital. The stump is flexed, and for this reason appears shorter than it was in reality, and for the same reason, also, the scar appears to be at the end of the stump, whereas it was located posteriorly, as is suggested at the lateral portion of the end of the stump. The end of the stump consists of practically all the tissue included in the oval bounded above by the lower portion of the crossing of the T, where adhesive plaster had been applied.

better than he can ever remember feeling since he was a boy. He is now working all day and states that at night he is not at all tired out. He is wearing an artificial leg and says he has not the least pain or discomfort in the stump.

Dissection of the amputated leg showed that the ankle-joint had been well opened. There was free thick yellow pus in the joint cavity, as well as in the soft parts about the ankle. There was a zone of soft, rough bone, moth-eaten in appearance, about the entire periphery of the articulating surfaces of the ankle-joint. This was about 1 cm. in width. The cartilage of the internal half of the trochlear surface of the astragalus was loosened, while over the posterior half of this region there was red granulation tissue. Removal of this loose cartilage exposed a spherical cavity in the astragalus, 2 cm. in diameter, with a ragged bony wall and soft, necrotic grayish-green content. The internal malleolus showed some absorption and the outer half of the lower epiphysis of the tibia was rough and softened, while beneath the periosteum a hemorrhagic exudate extended upward 10 cm. on the inner surface of the tibia.

The tibia and fibula were joined in their lower 20 cm. by compact bone 1 cm. thick, which replaced the interosseous membrane. Both in front and behind this formation, from the ankle up as high as the level of the head of the fibula, the muscular tissues were infiltrated with soft, white, opaque, putty-like material, in some places ossified. The muscle bellies were soft and friable, while their tendons were white and frayed on cutting. The putty-like material infiltrated the periosteum which was thickened, but did not invade the bone. There was marked atrophy of the gastrocnemius and soleus.

The resected knee-joint was completely ankylosed. The patella was absent. The femur and tibia were joined by bony union. In the midline in front was a continuous wire suture which penetrated 2 cm. into the bones. On the internal margin of the femur was a similar wire suture.

On complete dissection of the arteries, veins, and nerves all were found unchanged macroscopically.

On longitudinal and cross-sections of the tibia and fibula, calcaneous, astragalus, tarsal, metatarsal, and phalangeal bones, no further changes were found.

This examination showed that we were dealing with a chronic suppurative arthritis of the left ankle-joint with extension through the articular cartilage and secondary acute osteomyelitis of the astragalus and chronic suppurative periarthritis; chronic ossifying periostitis of the tibia and fibula with replacement of the interosseous membrane by compact bone; calcification and caseation of the soft tissues and muscles of the front and back of the leg; atrophy of the muscles on the back of the leg. Examination of the knee showed a total obliteration of the knee-joint. The lower end of the femur and upper end of the tibia showed the typical picture of a joint resection, with bony union between the apposed ends of the femur and tibia. The two wire fixation sutures noted in the roentgenogram were exposed and the one at the middle of the line of junction of the two bones showed a cavity about the wire.

Mal Perforant Du Pied.—In connection with this first case it may be of interest to briefly review the pathogenesis, clinical picture, and course of *mal perforant du pied*, together with the prognosis and surgical indications, and, in particular, to consider when amputation is indicated.

We are indebted to the French for our first knowledge of the condition, and it is usually referred to under the French name. From the time of Nélaton, who published a paper on the subject in 1852, the French literature contains many articles on the disease. Poncet in 1872 was the first to recognize the relation of the condition to disease of the nervous system, and it was shortly after this that the relationship between diseases of the spinal cord, particularly tabes, and perforating ulcer of the foot was established. There has always been considerable difference of opinion in regard to the pathogenesis of the condition, but it is now well established that it may result from several very different causes.

It occurs chiefly in males, and usually in men over forty years of age. It is very rare in the young, though 2 cases have been reported in children. Max Hoffmann, in an excellent article in the Ergebnisse der Chirurgie und Orthopedie, 1914, pp. 909–930, with a report of 19 cases, pointed out that all his 19 cases occurred in men. Furthermore, it occurs almost always in working people who are on their feet a great deal, and the ulcer occurs at points of pressure on the plantar surface of the foot. There are three typical sites where the ulcer occurs. These are beneath the metatarsophalangeal articulation of the great toe, beneath the fifth toe, and beneath the heel.

In the course of time four theories of origin have been brought forth. These are: First, the *mechanical* theory; second, the *vascular* theory; third, the *nervous* theory; fourth, the *arthropathy* and *osteopathy* theory.

The *mechanical theory* may be dismissed with very few words. While pressure and trauma unquestionably are important in determining the site and development of the ulcer, these mechanical factors must be regarded as only contributory and not as the underlying cause. It may be pointed out that a perforating ulcer may occur in areas not subjected to pressure or other mechanical trauma, and that the ulcers are frequently not cured by rest in bed, and may even grow progressively worse.

The *vascular theory* assumes a chronic vascular disease, an obliterating arteritis, is the underlying cause. This theory is no longer held. Arteriosclerotic changes, when present, are looked upon as a mere coincidence in most cases. Usually there is no, or but very little, arteriosclerosis. When present and limited to the area about the ulcer, as sometimes is seen, the arteriosclerosis is probably the result and not the cause of the disease.

The *nervous theory* is based upon the belief, which is generally accepted today, that the chief factor in the pathogenesis is some change in the nervous system. The underlying nervous lesion may be located in the central nervous system or in the peripheral nervous system. It results in sensory, vasomotor, and trophic changes which may affect the nerves of the entire limb or be limited to the portion of the nerves immediately in the vicinity of the ulcer. The changes are either a parenchymatous or an interstitial neuritis. The following types and causes of peripheral neuritis may lead to the development of *mal per-*

forant: Traumatic neuritis irrespective of the nature of the trauma, tumors of the nerves, tumors that press upon the nerves, pressure upon the nerves by callus, etc., alcoholic neuritis, neuritis following freezing or burns, neuritis of leprosy, etc. The anesthesia seems particularly to favor the development of a perforating ulcer.

Changes in the central nervous system apparently play a more important rôle, particularly tabes dorsalis. Other important causes are: damage to the cord due to fractures of the vertebræ, tumors of the cord, spina bifida with its associated cord changes, and syringomyelia. Less frequent causes are: paresis, progressive muscular atrophy, amyotrophic lateral sclerosis, and spastic spinal paralysis.

The nervous theory of origin is apparently substantiated by the frequent finding of neuropathic arthropathies associated with perforating ulcers of the foot.

Although typical perforating ulcers of the foot have been reported in diabetics, the typical diabetic ulcer differs from the typical *mal perforant.* The diabetic ulcer is usually painful, whereas the typical *mal perforant* is characterized, as a rule, by the entire absence of any pain.

The *arthropathy* and *osteopathy theory* was recently suggested by Levy, who believes that the arthropathies and osteopathies are the cause of ulcer formation. Serious objections have been raised against this theory. The bone and joint changes (arthropathies and osteopathies) found associated with perforating ulcers of the foot, like the ulcer, are due to changes in the nervous system. These bone and joint changes in some cases come on before the ulcer appears; in other cases they develop simultaneously with the development of the ulcer, and in still other cases they do not occur until after the ulcer has made its appearance.

It is clear that the causes of the ulcer are multiple; that the nervous factor is the most important, and that pressure and trauma are important contributing causes in determining the site and development of the ulcer.

The clinical picture in a typical case is about as follows:

(*a*) A pressure callus develops at one of the sites of election—under the ball of the great toe, ball of the small toe, or under the heel. This is always suspicious in a case that presents some lesion of the spinal cord or of a peripheral nerve, which experience has shown is commonly accompanied by *mal perforant du pied.* This primary callus does not differ from an ordinary callus, and is merely a localized hyperkeratosis. From this callus alone it is not possible to make a positive diagnosis of a beginning perforating ulcer, though if a roentgenogram of the foot be taken and this shows the presence of an arthropathy or an osteopathy, a presumptive diagnosis can be ventured. (*b*) A little later this horny layer becomes thin at the center. (*c*) Secretion collects beneath the thin scar. (*d*) Finally, the thin covering horny layer ulcerates through at its center, and gives rise to a small superficial ulcer. This ulcer shows no tendency to heal. It may epithelialize, but then it breaks down again. Gradually the ulcer grows deeper and deeper, and broader and broader. It maintains its round form, and is surrounded by a wall of greatly thickened epidermis. The ulcer secretes a thin watery fluid. If, later, secondary infection of the ulcer takes place, the ulcer may secrete foul pus. The ulcer is painless, as a rule, and this is typical. Usually there is more or less anesthesia of the skin about the ulcer, even when no other evidence of a nerve lesion is present. Pain or tenderness if present in the skin about the ulcer speaks against the correctness of the diagnosis. Other (trophic) changes are often present, as trophic changes of the nails (as in this case, Fig. 456); localized thickening of the skin epithelium in other places, as on the dorsum of the foot; local changes in the amount of sweat secreted, either increased, decreased, or absent; and finally, and most important, trophic changes in the overlying or adjacent bones or joints. Duplay and Morat as early as 1773 pointed out that primarily erosions of the cartilage of the neighboring joint are observed, with later destruction of the joint, ankylosis, and the formation of a fistula. It is common on probing a perforating ulcer to find that the probe follows upward through a fistula that enters the neighboring joint, and that the probing is entirely painless. And it is certain that the bone and joint changes and the perforating ulcer have a common cause, and that is nervous in origin. Rotter, Volkman, and Virchow believed that the ulcer was the cause of the arthropathy. Today, however, most authors believe that the arthropathy is the result of a central or peripheral nerve lesion. As mentioned before, Levy believes that the changes in the bone and joint are the cause of the ulcer.

As regards differential diagnosis the following ulcerative conditions have to be ruled out: Tuberculous ulcers, luetic ulcers, ulcers of leprosy, diabetic ulcers, fistula from suppurative bursitis, atheromatous ulcers, ulcerated sarcoma, and carcinoma.

The roentgenologic findings are often of great value in the differential diagnosis. The absence of bone atrophy in *mal perforant* is typical and stands out conspicuously in contrast to the marked destruction of the ends of the bones at the joint. Bone atrophy may develop later from disuse, but in cases of doubt as to the correctness of the diagnosis of *mal perforant* this absence of bone atrophy may decide the diagnosis, as, for example, against tuberculosis. In the case of our patient with the ulcer beneath his heel, the roentgenograms (Figs. 457, 458) show changes in the ankle-joint in the form of an arthropathy; you can see the new bone deposited and the widening of the joint surfaces which have become somewhat irregular, and at the same time note that there is no bone atrophy of the shaft of the tibia or fibula—indeed, these are thickened by a circular periostitis. Both tuberculous ulcers and diabetic ulcers are characteristically painful, in contrast to the absolute anesthesia of the ulcer in *mal perforant*.

The prognosis of *mal perforant* is bad as to cure. The ulcer is difficult to heal and tends to recur. It predisposes to suppurative arthritis, lymphangitis, erysipelas, cellulitis, sepsis, and gangrene of the toes and foot. Hoffman reports that 2 of his 19 cases died of infection.

As regards treatment, one must not only treat the local condition, the ulcer, but wherever possible treat the underlying causal condition as well. Treatment must be directed to the etiologic factor where this is possible, as in arteriosclerosis, alcoholic neuritis, lues, etc. This is particularly important in peripheral nerve lesions, as compression by callous neuritis.

Without going into details as to the local treatment, the following methods have been reported by various authors as having proved of benefit in certain cases: the use of constant and induced electric currents; *x*-ray treatment locally; high-frequency currents; hot-air treatment; nerve stretching; paraffin injections to broaden the pressure surface, etc. It is essential to keep the patient off his feet during healing and to keep all pressure off the ulcer. It is best to keep the patient in bed. The ulcer must be dressed aseptically and kept clean.

Lasting results can be achieved only by surgical intervention. In cases in which no connection exists between the ulcer and the neighboring joint or bone, careful and complete excision of the ulcer, going well into healthy tissue, is all that is required. This can usually be done, as in this case, without the use of any anesthetic, as there is usually total anesthesia of the tissues about the ulcer. If the ulcer is very superficial it may suffice to excise merely the thickened epidermis that forms the margin of the ulcer. But it is best to dissect off the floor of the ulcer in order to determine whether there is not a communication with the adjacent joint. For this reason it is best to operate with a constrictor applied. In case one finds that the ulcer communicates with the joint or bone, all destroyed bone should be removed so as to have the conditions most favorable for a cure and guard against a recurrence.

Occasionally, secondary infection of so extensive a nature develops as to threaten the patient's life. Here more radical operations are required. It is only rarely, however, that amputation is indicated, as in this case. *Amputation is most often indicated in perforating ulcers due to a lesion of the central nervous system, as tabes, paresis, syringomyelia, spina bifida, etc., for in these conditions simple excision is usually followed by recurrence.* If after the proper local treatment or excision the ulcer recurs, small amputations, as of a toe or part of the foot, or low amputations of the leg, are allowable, but must be followed by careful after-treatment and avoidance of weight bearing. These low amputations usually heal readily, but the ulcer is likely to recur within two or three months. Bland-Sutton reported a case in which re-amputation had to be repeated several times in a patient suffering with perforating ulcer first on one foot and then on the other. In his case, one of spina bifida, seven amputations were performed, and even then without cure. Perhaps in such a case, *if a low amputation is followed by recurrence, it may be advisable to do the second amputation at once high up through the thigh*, as suggested by Petersen (Deutsche Chirurgie, Lieferung, 29a, p. 70).

Case II.—The second patient is a laborer, forty-five years of age, who came to the hospital November 18, 1920 because of stiffness and pain in the left knee, and two discharging sinuses, one above and one below the knee-joint. He also complained of swelling in the right groin and scrotum.

The trouble in the knee began thirty-three years ago following a slight local trauma. Immediately following this a swelling appeared and some pain. In four or five days the swelling began to subside, but for seven years there was some stiffness of the knee, but no great disability or discomfort. Then, without any assignable cause, the knee again began to swell and considerable pain developed. He accordingly consulted a physician. An incision was made and caseous material discharged. The wound did not close for three months. Following this the joint became stiff and has remained so ever since. Occasionally the knee would swell up, but the patient was able to work as a laboring man on a farm and in a shop. Four months ago a sinus appeared on the inner side of the leg below the knee (Figs. 460, 461). This discharged a light yellow, thick, foul pus which has continued up to the present time. A few months ago some pieces of bone were discharged. The knee became so painful that the patient was unable to work, and for this reason came to the hospital. Otherwise the history shows nothing of interest except for the fact that he is troubled with night-sweats.

Examination on entrance showed that the patient was a well-nourished man who did not appear ill. The findings of

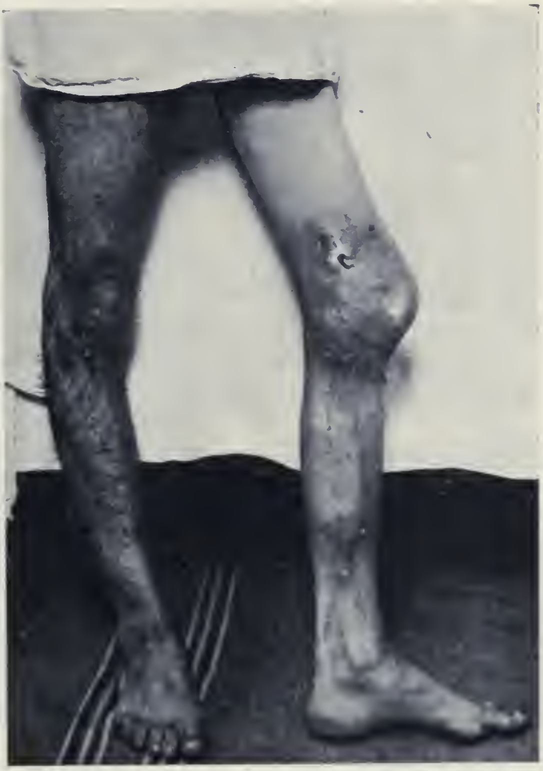

Fig. 460.—Photograph of both legs, Case II, anterolateral view, taken with leg shaved for operation. The left lower extremity shows atrophy of all the muscles and the knee fixed in flexion at an angle of about 130 degrees. There is a typical spindle-shaped swelling at the knee, with subluxation of the leg backward, so that the line of the tibia, instead of meeting that of the femur at the knee-joint, cuts through the junction of the middle and lower third of the femur. This posterior subluxation and external rotation can be seen even more plainly in Fig. 461. There is also a typical external rotation of the leg. Both the posterior subluxation and the external rotation are typical findings in tuberculosis of the knee-joint of long standing, in which marked exudation has occurred into the joint, with resulting relaxation of the joint capsule and ligaments. The weight of the leg produces a backward sagging and the weight of the foot an outward rotation of the leg. There are two fistulæ in relation to the knee-joint, both on the medial side, one well above and the other about 2½ cm. below the joint line. The discharge from these fistulæ can be plainly seen trickling down the leg.

interest were a few palpable cervical lymph-glands on both sides; the fact that the chest was long, thin and flat, with expansion only fair; that the lungs showed excursion fair, slight impairment of resonance over the right apex and right upper lobe, with harsh breath sounds over this area and prolonged expiration, but no râles—apparently an old healed tuberculosis of the right upper lobe. Heart findings were normal. There was a slight scoliosis to the right in the lower thoracic region. Abdominal examination was essentially negative. The left lower extremity showed atrophy of all the muscles and the knee fixed in flexion at an angle of about 130° F. (Figs. 460, 461). There was a typical spindle-shaped swelling at the knee, with posterior subluxation of the leg, so that the line of the tibia instead of meeting that of the femur at the knee-joint cut through the junction of the middle and lower third of the femur. Also there was a typical external rotation of the leg (Figs. 460, 461). Both the posterior subluxation and the external rotation are typical findings in tuberculosis of the knee-joint with marked exudation into the joint. This causes relaxation of the joint capsule and ligaments. The weight of the leg produces a backward sagging and the weight of the foot an outward rotation of the leg (Fig. 461). There were two fistulæ in relation to the knee-joint, both on the medial side, one well above and the other about 2½ cm. below the joint line (Figs. 460, 461). The entire knee

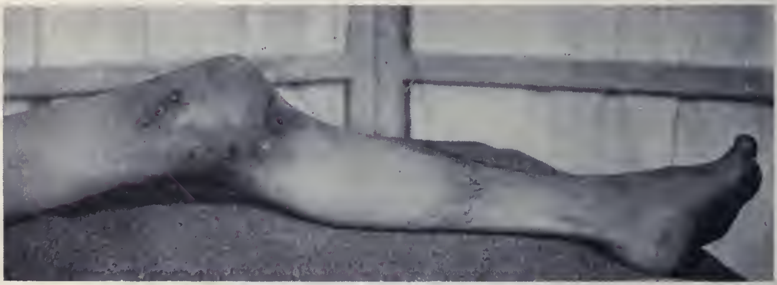

Fig. 461.—Photograph of left leg taken just before operation, lateral view. This shows particularly well the subluxation of the leg backward and the external rotation of the foot. Note also the fistulæ described in Fig. 460.

region, in addition to being fusiformly enlarged, was slightly red, but showed no increase of local temperature. The patella was firmly ankylosed and the knee-joint showed bony ankylosis.

From the findings the diagnosis was obvious—tuberculosis of the right knee. In order to determine the exact extent of the disease roentgenograms were taken. These (Figs. 462, 463)

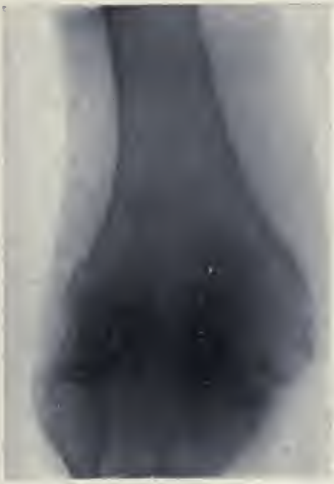

Fig. 462.—Roentgenogram of left knee-joint (Case II), anteroposterior view. This shows the typical picture of tuberculosis of the knee-joint in a case of long standing. Note the old destructive arthritis of the knee-joint, with total obliteration of the joint. The lower end of the femur shows an area of absorption at the internal condyle, extending upward and involving the epicondyle. Note also the secondary arthritis deformans of the joint, which is evidenced by a widening of the joint surface due to new bone deposit. This is particularly striking at the lateral margin of the joint surface, where there is a marked new deposit of bone on the lower end of the femur and on the upper end of the fibula, with marked lipping. The bone atrophy typical of tuberculosis is well shown.

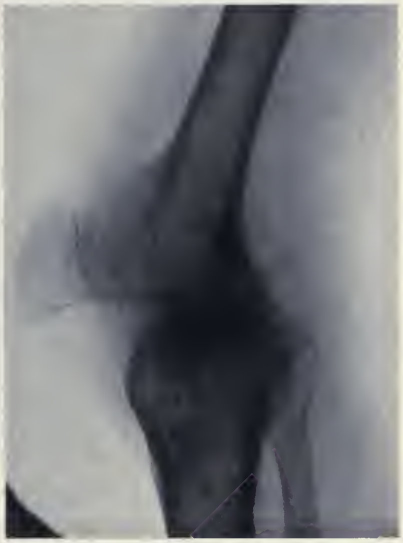

Fig. 463.—Roentgenogram of left knee-joint (Case II), lateral view. This also shows total obliteration of the knee-joint. This view shows particularly well the typical *lamellar apposition* (periostitis) about the metaphysis of the femur, found characteristically in tuberculosis of the long bones. New bone deposit is seen on the patella. The lipping described in Fig. 462 can be well seen posteriorly.

showed an old destructive arthritis of the knee-joint with total obliteration of the joint. The lower end of the femur showed an area of absorption at the internal condyle (Fig. 462). There was typical *lamellar apposition* (periostitis) at the metaphysis of the femur (Fig. 463) as is found characteristically in tuberculosis of the long bones. The tuberculous changes in the end of the femur are seen to extend for some distance upward into the lower portion of the shaft of the femur. In ordinary purulent osteomyelitis the periostitis is characteristically amorphous, that is, shows no structure, and has been compared to plaster thrown against the bone, and it extends more or less up the diaphysis and circularly about it. In tuberculosis of the long bones, on the other hand, the new bone formation, *i. e.*, apposition, is usually only slight, occurs only where the diaphysis passes over into the epiphysis, that is, at the metaphysis, often occurs only in relation to the tuberculous bone focus and not entirely around the bone, and is deposited during the exacerbations of the disease, and this gives it a lamellar structure. These features are quite typical and allow one to differentiate it very readily from ordinary purulent osteomyelitis.

Bacteriologic examination was made from the pus obtained from the fistulæ. Smears failed to show any tubercle bacilli, but one does not expect to find tubercle bacilli in fistulæ from tuberculous bone foci. Cultures showed streptococci. When a tuberculous bone abscess ruptures to produce a fistula it is the rule that secondary infection develops. This is usually either a staphylococcic or streptococcic secondary infection.

Blood examination showed hemoglobin 80 per cent., red blood count 4,000,000, white blood count 6000. This low white blood count, leukopenia, is characteristic of tuberculosis. A differential white blood count showed small mononuclear lymphocytes 40 per cent., large mononuclear lymphocytes 8 per cent., polymorphonuclear neutrophils 50 per cent., eosinophils 2 per cent. This relative increase in lymphocytes with a relative decrease in polymorphonuclear neutrophils is also characteristic of tuberculosis. Urinary examination was entirely normal. Amyloid casts were especially examined for, but none were found.

The temperature chart showed a normal temperature with only one reading of 99.4° F. Pulse ranged from 66 to 96, being usually from 72 to 80. Respirations were 18 to 20.

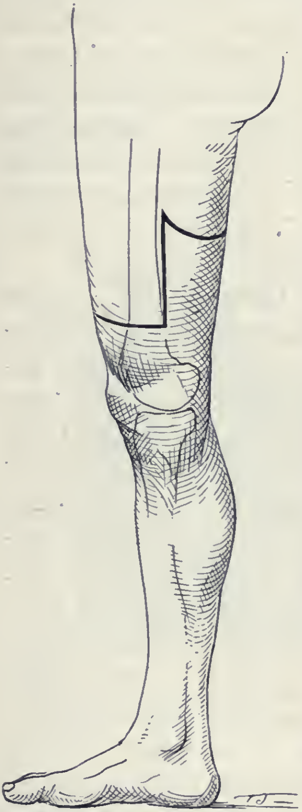

Fig. 464.—Diagram showing method of cutting flaps in amputation of the thigh in cases with marked atrophy of the soft parts.

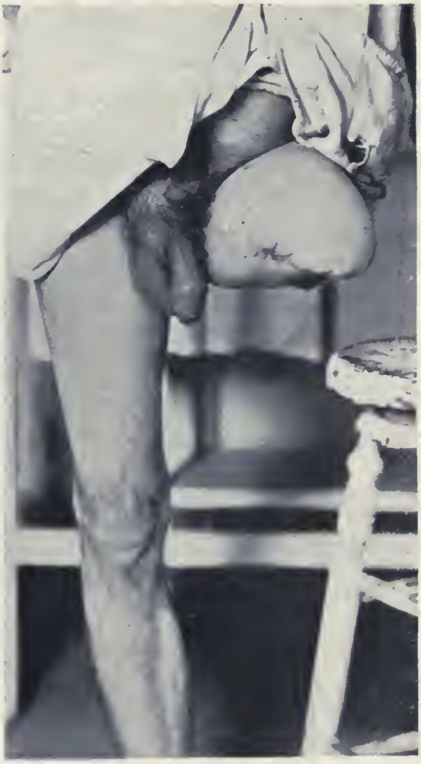

Fig. 465.—Photograph of amputation stump (Case II) taken shortly before the patient was discharged from the hospital. The stump is flexed, and for this reason appears shorter than it was in reality. The end of the stump is directed toward the camera. The scar is located posteriorly, well away from the end of the stump.

The case is interesting from the standpoint of surgical indications as regard treatment. Ordinarily the usual treatment for advanced tuberculous gonitis (tuberculosis of the knee-joint) is resection of the joint. Amputation is rarely indicated. *The indications for amputation in cases of tuberculosis of the knee-joint are:* 1. Marked general weakness—here the benefit to the patient of removal of this large focus of tuberculosis may give him the opportunity of turning the balance in his favor. 2. Multiple foci of tuberculosis, severe phthisis, amyloid, etc. 3. In old people, over fifty years of age, unless they are too weak to stand amputation. 4. Too marked destruction of the knee to permit of resection. 5. Infiltrating type of tuberculosis, extending into the diaphysis. In this patient, his age, forty-seven years, and the extent of the disease gave the indications for amputation. Resection would have been impossible.

A typical aperiosteal amputation of the thigh with a longer anterior and a shorter posterior flap was performed November 30, 1920. In order to cut the anterior flap well away from the fistula above the knee-joint and to divide the femur well above the tuberculous process in the bone the amputation had to be made through the middle third of the femur. On account of the marked atrophy of the thigh the flaps were cut rather rectangularly (Fig. 464). A drain was inserted across the lower angle of the stump. This was removed on December 3d. Following the operation he was given the Hirsch method of after-treatment. He left the hospital on January 8, 1921 with an entirely healed, completely painless, and good end-bearing stump.

Case III.—The patient, T. Z., a laborer, thirty-nine years of age, entered the Cook County Hospital November 27, 1920 because of a bloody discharge and tenderness at the end of an amputation stump of the left thigh. The leg was amputated eight years previously because of a severe cellulitis of the leg which had been present for about one year. The patient does not know the exact nature of the trouble, but he says the foot was greatly swollen; at first the nail of the great toe and later the entire great toe was removed, and finally the leg. From the time the leg was amputated until five months ago the patient had absolutely no trouble with the stump. Five months ago the end of the stump became tender, red, and swollen. Some days later there was a spontaneous discharge of bloody and purulent material. The discharge continued, but varied in amount from day to day, and was always more bloody than purulent. Because of the local tenderness the patient was unable to wear his artificial limb, and it was for this reason that he entered the hospital.

He was well-nourished and did not appear ill. There was nothing of interest in the general examination except the local findings. The left leg had been removed a short distance above the knee. The amputation stump was rather conical (Fig. 466). The end of the femur was covered by skin only.

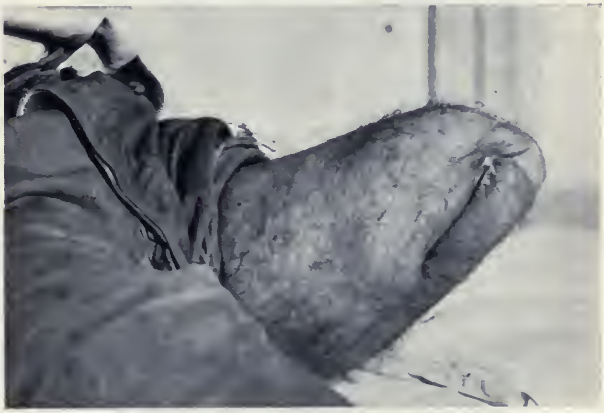

Fig. 466.—Photograph of old conical amputation stump, Case III, showing fistula due to osteophyte shown in Figs. 467, 468.

The anterior surface of the end of the femur similarly was covered only by skin (Fig. 467), the flexor group of muscles ending a short distance above the end of the bone. Posteriorly, the extensor muscle group extended to the end of the femur. In the central portion of this muscle mass and a few centimeters above the end of the stump a depressed area was seen in which the fistula ended externally (Fig. 466). The skin about the fistula was somewhat red and infiltrated. The corresponding regional left inguinal glands were enlarged and tender. Palpation in the region of the fistula disclosed the presence of an osteophyte extending almost to the skin.

A roentgenogram (Fig. 467) showed a typical osteophyte from the middle of the posterior surface of the end of the stump extending almost to the skin. The fistulous tract extended from the tip of this osteophyte out to the skin. There was no evidence of osteomyelitis of the stump of the femur.

From the clinical and roentgenologic findings it was clear that the sequence of events had been as follows: The osteophyte had developed from the end of the stump and had grown until it reached almost to the skin. The pressure of his artificial limb against the osteophyte had resulted in the formation of a small ulcer due to pressure necrosis, with the subsequent development of a secondary infection and a resulting fistula.

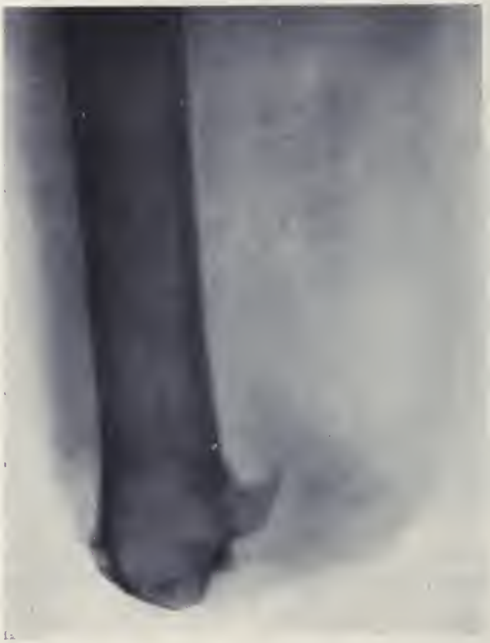

Fig. 467.—Roentgenogram of old amputation stump (Case III) showing osteophyte, from which fistula extends to the skin on the posterior surface of the stump, as shown in Fig. 466. Note that the end of the femur is uncovered by muscle.

The surgical indications were obvious—the removal of the osteophyte and complete removal of the fistulous tract. In view of the fact that the stump was a conical one it was decided to resect the terminal portion of the femur well above the osteophyte in order to be able to bring the muscles over the end of the bone.

The patient was operated upon December 7, 1920. With the patient drawn down to the end of the table, so that the intact knee was bent and the sound foot rested on a stool, the stump was held vertically upward and an Esmarch constrictor applied high up. Then, with an ordinary scalpel, an anterior long flap and a posterior shorter one were mapped out, sacrificing as little skin as possible and yet cutting away the skin which was adherent to the end of the femur, and in back, the skin about the fistula. When the muscles were exposed, care was taken not to sacrifice any muscle except immediately about the fistula. An anterior and a posterior muscle mass were thus exposed with very little bleeding. The stump of the sciatic nerve was seen with a moderate bulbous swelling at its end, but this was deemed unnecessary to resect. The bone now being well exposed all

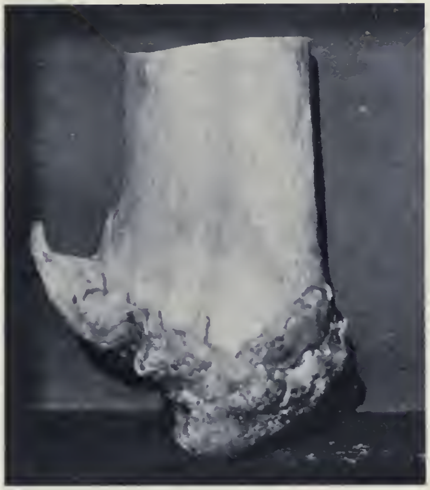

Fig. 468.—Photograph of lower end of old amputation stump of femur removed at operation, showing the osteophyte (Case III).

about, and holding the muscles well retracted to allow the saw to be used, the distal 6 cm. or so of the femur (Fig. 468) were cut away by means of a Helferich saw. After this end of the femur had been removed, the distal 1 cm. of the periosteum and the distal 1 cm. of the medulla of the femur were removed. The constrictor was now taken off. There was no special bleeding. The muscles were sewed together over the end of the bone by means of interrupted chromic catgut stitches and the skin was closed without drainage.

Postoperative course was uneventful; the wound healed by primary union. In order to obtain a painless stump the Hirsch method of after-treatment was carried out. This will be referred to later. The patient left the hospital on December 23d, and by this time was able to wear his old artificial limb. On January 7, 1921 he was requested to appear before a clinical meeting of the Chicago Surgical Society. He came to the meeting, but by mistake took the wrong street car and he walked over one mile to the hospital, and without pain or injury to his stump. This was four weeks after the amputation.

Technic of Amputation of the Thigh.—The technic of amputation of the thigh depends on several factors. As a general rule it may be stated that, so far as the local conditions permit, as much of the femur as possible should be saved. In other words, it is of distinct advantage to have the stump of the femur as long as possible. The Gritti-Stokes is probably the best amputation at the knee. Above the condyles end-bearing decreases the shorter the femoral stump, and leverage likewise progressively diminishes. When the stump of the femur is less than 3 inches in length, measured from the pubis, it is of no value for leverage or end-bearing, and disarticulation at the hip is preferable to amputation at this level. When a disarticulation at the hip has been performed, the patient can be supplied with an artificial limb which allows of a better gait than can be secured with a stump as short as 3 inches. Taylor[1] believes that in these cases it is much better to cut through the greater trochanter than to disarticulate, that disarticulation increases the risk very materially, and that often the condition of the patient does not warrant or demand it; that when amputation has been done so that the femoral stump is less than 2 inches, as measured from the pubis, the end of the bone projects laterally, and that a padded shelf upon which this can rest may be made in the artificial limb, which gives a comfortable and much more useful artificial limb than if the head of the bone were removed.

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[1] Keen's Surgery, vol. viii, 1921, p. 85.

Where the disease or damage to the bone or soft parts makes it necessary to amputate above the condyles, the method I prefer under ordinary circumstances is the use of a long anterior flap and a shorter posterior flap. Many surgeons believe that in thigh amputations a long antero-external flap and a shorter postero-internal flap give the best stump. These flaps are cut through as nearly normal tissue as possible. When one has to amputate through infected or doubtful tissue, very short flaps or even the guillotine method may be indicated, as in war surgery.

As the 3 cases demonstrated this morning presented local conditions indicating amputation above the condyles, I shall discuss this method in detail.

The operation is ordinarily best conducted under general ether anesthesia. Where the patient is in moderate shock, it is usually best to delay amputation until he has had time to recover from the shock. However, in some cases where patients have been operated upon in slight shock, the removal of the damaged extremity has been followed by recovery because the condition producing the shock has been removed. In rare cases where the patient is brought in in profound shock, suffering with a severely mangled extremity and his condition does not rapidly improve, and where one would not attempt an amputation under general anesthesia, one may consider using a spinal anesthesia in order to combat the shock by cutting off the afferent nerve impulses. In case the patient's general condition improves one may then resort to amputation. I recall one case of a boy who had been run over by an automobile truck which had torn off an enormous amount of skin from his lower abdomen, buttocks and thigh, and caused a compound fracture of his femur. He was brought into the hospital in profound shock, but was conscious, though pulseless. The ordinary treatment of shock was carried out with great care, but the boy never recovered from his condition of shock, and no operation was undertaken—not even cleansing of the wounds. I have always felt that that boy might have had the benefit of one more attempt to save him if he had received spinal anesthesia while we were waiting for him to recover from his shock. Ordinarily the use of spinal anesthesia in thigh amputations is to be condemned, as the mortality from its use is extremely high.

As soon as the patient is anesthetized the limb to be amputated is held vertically upward for a few moments to allow it to empty as much blood as possible, and then a constrictor is applied well up near the groin. There are many satisfactory methods and devices for securing constriction. My personal preference is the use of a Martin rubber bandage applied over a towel. Before applying the bandage that is to remain on as a constrictor all blood possible is expelled from the limb by applying a Martin bandage, beginning at the toes and winding the rubber bandage about the limb in an ascending spiral manner until the upper third of the thigh is reached. Here an ordinary hand towel, folded once on its long axis, is smoothly wound about the thigh at its upper third, and over this the Martin bandage that is to remain on as a constrictor is applied, care being given to see that the bandage is held stretched and that it is applied over a wide zone about the thigh.

The use of this method of expressing the blood from the extremity before applying the constrictor is contraindicated in case the operation is done for a septic condition or a malignant tumor, for fear of spreading the infection or disseminating the tumor cells in the blood-stream. The use of the Sehrt clamp in its original or modified form has one definite advantage. After the clamp has been removed, if brisk bleeding occurs, the hemorrhage can be rapidly controlled by again applying the clamp without disturbing the asepsis. In old persons with arteriosclerotic vessels it is often best to work without applying any constrictor, and control the bleeding by digital compression alone.

The constrictor having been applied, the patient is drawn down so that his pelvis is at the end of the table. The sound limb is abducted, flexed at the knee, and the foot placed on a low stool, so that the leg below the knee hangs vertically downward (Fig. 469). The limb to be amputated is held projecting horizontally beyond the table. This is held by the second assistant, who stands beyond the patient's foot (Fig. 469). The operator always stands to the right side of the limb to be amputated. For this reason, in case the left limb is to be amputated, the operator stands between the two limbs (Fig. 469). In order to do this easily the right limb is moderately abducted before it is flexed and the foot placed on the stool. The left limb is also held abducted (Fig. 469). This is an old rule and should be followed, as it facilitates the operation.

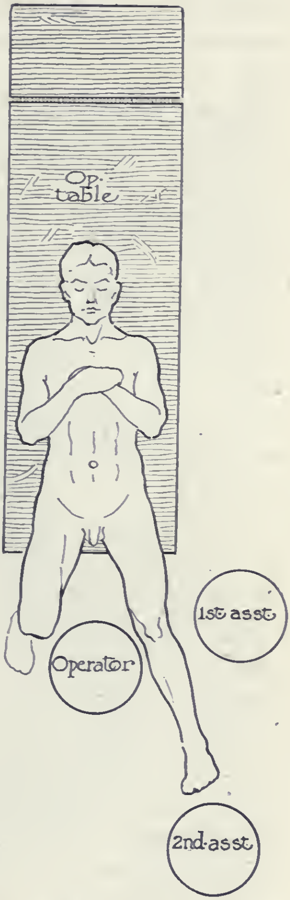

Fig. 469.—Diagram showing position of patient on the table and the arrangement of operator and assistants when the left thigh is to be amputated.

The operator now outlines his flaps by a light touch with a scalpel. If the patient's thigh is not emaciated I use a long curved anterior flap and a short curved, almost circular posterior flap, the posterior one not being more than one-third the length of the anterior one. The anterior one is as long as the full anteroposterior diameter of the thigh at the site of the proposed bone section. By so doing the scar will lie well posteriorly. The flaps are cut, leaving the skin attached to the muscles, and beveling the muscle-flaps to the bone. When, however, as in the first 2 cases demonstrated, the limb muscles are greatly atrophied, I frequently outline the flaps more angularly (Fig. 464), and later, when closing, merely trim off the sharp corners. In such cases I proceed as follows: Using an amputating knife not over 6 inches in length, I make a longitudinal incision on either side of the thigh and just posterior to the femur. These incisions are just as long as the anteroposterior diameter of the thigh at the proximal end of the flap. Above, the scalpel is carried deep into the muscle substance, whereas below the incision is progressively more and more superficial until at its lower end it reaches only to the muscle. After having made these two lateral incisions, a transverse incision is made across the front of the thigh connecting the lower ends of the two lateral incisions. This extends merely down to the muscles. Two sharp retractors are now inserted so as to make traction on the anterior flap, which is now cut by making further transverse strokes with the scalpel from the one to the other longitudinal incision. In this manner the flap is formed, consisting of skin left attached to the muscle which is beveled until the bone is reached (Fig. 470). After the anterior flap has thus been cut and held retracted upward, a large gauze compress is applied, and then the limb is raised vertically to facilitate cutting the posterior flap. The posterior flap is cut in exactly the same manner as the anterior flap, except that it is beveled more vertically. After the two flaps have been cut and retracted, any remaining muscle bundles are divided by a circular sweep of the scalpel about the femur.

The two flaps are now held strongly retracted well proximalward by means of a two-tailed retractor of muslin, so as to expose the periosteum for several centimeters above the proposed line of bone section, and the leg is now returned to the horizontal position. The periosteum is cut circularly about the bone, retracted upward and downward a short distance, and the bone now sawn squarely across. It may be pointed out that in sawing any bone two small points of technic are helpful. The saw should be drawn back and forth the full length of the blade, and, what is more important, no weight should be applied to the saw, but the strokes should be very light, the saw being allowed to cut through practically by its own weight alone. I prefer the old Helferich saw for dividing the femur, and if it is used in the manner just pointed out it will sing just as one hears the butcher's saw. While sawing, the blade should be kept cool by an assistant squeezing water from a very wet gauze sponge, so that the water falls slowly but almost constantly over the portion of the bone that is being cut. The assistant should take care that the leg

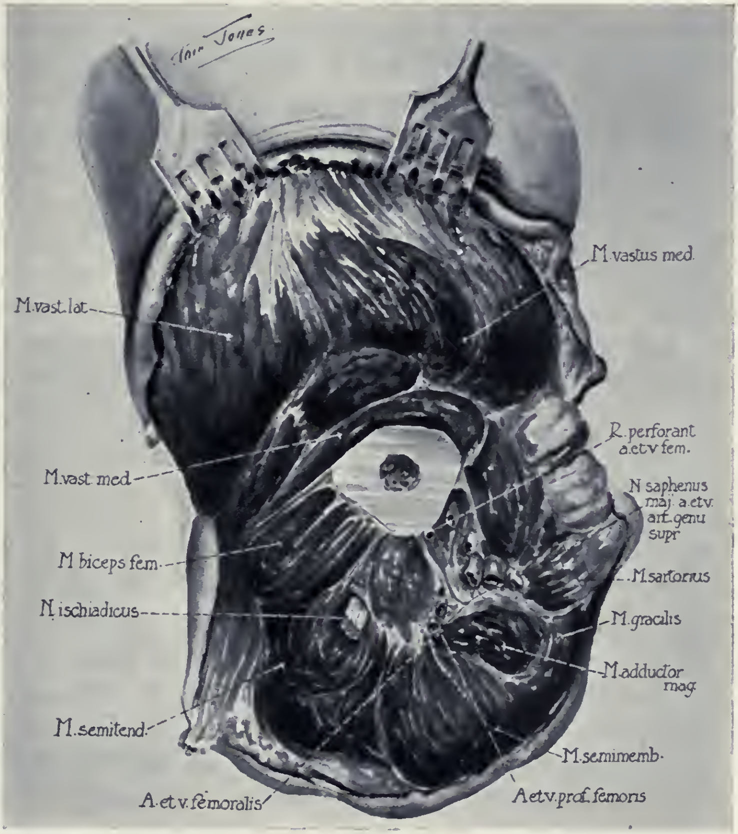

Fig. 470.—Diagram (after Axhausen) of amputation stump showing topographic anatomy.

is held firmly in line during the last few cuts of the saw, so that the bone does not break from the weight of the leg. When the leg has been removed, the stump is strongly flexed at the hip, and the large vessels and nerves are sought. If one is familiar with their location and landmarks they are all readily found.

The femoral artery and vein are first looked for and clamped. These lie behind and just lateral to the sartorius muscle. The sartorius muscle can readily be located by remembering that it lies at the most mediolateral portion of the stump just behind the quadriceps group of muscles (Fig. 470). The femoral vessels may have retracted into the depths, but they can easily be found if one recalls their relation to the sartorius muscle. The artery usually lies in front of the vein. All other bleeding vessels are clamped as quickly as possible. These smaller vessels lie for the most part in the intermuscular septa. Branches of the deep femoral artery and vein, perforating branches, are sought for immediately behind the linea aspera, and beside the sciatic nerve (Fig. 470). After all these vessels have been clamped, they are ligated in the ordinary manner. Attention is next given to the nerves.

The proper treatment of the nerves so as to prevent neuroma formation, as far as possible, is one of the chief factors in accomplishing an end-bearing painless stump. Although several methods have been devised to accomplish this, two methods are at present most commonly advocated and used: (*a*) the method of Ritter and (*b*) the method of Krüger.

(*a*) Ritter's method consists in cutting the nerve in a fish-tail manner so that the distal end of the nerve stump has an inverted V shape. When the nerve which has been so divided retracts into its sheath the two sides of the V tend to become approximated and to prevent the nerve-fibers from straying from the end of the nerve stump, which becomes covered by the sheath after the nerve has retracted. The Ritter method is practicable only in case of large nerves like the sciatic. In case of the smaller nerves all that is necessary is to draw them downward as far as possible and divide them high up, so that they will retract well away from the scar.

(*b*) A new method of treating the nerves to prevent straying of the fibers and painful neuromas was devised during the recent war by Krüger (München. med. Wchnschr., 1916, No. 10). Krüger crushes the nerve at the proposed site of division high up by means of a crushing clamp. This clamp completely destroys the nerve-fibers, but leaves the nerve sheath intact. The nerve is divided through this crushed area, so that the ends of the divided nerve-fibers are covered by the sheath. Straying of the regenerated axis-cylinders is thus prevented and painful neuromas are avoided. Payr has warmly recommended the method. While it seems a rational method and is applicable to nerves of all sizes, not enough cases have yet been reported and the after-results studied to allow one to evaluate the merits of the method at the present time. Ritter has pointed out that one should be slow to employ the method in case of an infected stump, as in war surgery, since the crushed area must break down in part, and he believes this might favor adhesions.

Very recently Huber and Lewis (Archives of Surgery, Vol. I, No. 1, July, 1920, pp. 85–113) have presented experimental evidence which shows conclusively that the inverted V operation of Ritter and the "crush and tie" operation of Krüger do not prevent neuroma formation. They find that if after the nerve is divided the trunk of the nerve is injected with absolute alcohol by means of a hypodermic syringe and fine needle, introducing the alcohol from $\frac{3}{4}$ to 1 inch above the plane of section and using enough alcohol to make the nerve appear a dull white, neuroma formation is thereby more successfully prevented than by any of the other methods ordinarily employed.

Irrespective of whichever method one employs in treating the nerves, it is well to proceed in a systematic manner. The saphenous nerve accompanies and lies immediately in front of the femoral vessels (Fig. 470). It is isolated, drawn down as far as possible, divided high up, and allowed to retract. Next, the sciatic nerve is sought. The sciatic nerve lies just behind the biceps muscle (Fig. 470), deep in the posterior portion of the stump. The muscles behind the femur are divided into two main masses, the adductor group on the medial side, and the flexor group on the lateral side. The biceps is the most laterally located muscle of the flexor group (Fig. 470).

In the 3 cases just presented the sciatic nerve was treated by the Ritter method. Before dividing the nerve high up the nerve stump was drawn downward as far as possible and blocked with $\frac{1}{2}$ per cent. novocain so as to prevent shock. The shock that accompanies high amputations is believed to be due chiefly to high division of the large nerves. In order to reduce this as much as possible, the nerve is blocked before it is divided. This is quickly and easily accomplished by injecting it with $\frac{1}{2}$ per cent. novocain or cocain solution, using an ordinary hypodermic syringe and a very fine needle. When the contents of the syringe are injected the nerve swells slightly. The division is made through the swollen area.

Now the large internal saphenous vein is sought and ligated, and any other visible subcutaneous veins. Also, any superficial nerves encountered are shortened. Next, the periosteum is removed from the terminal 1 cm. of the stump of the femur and the marrow cureted out for the same distance. This is known as the Bunge method of aperiosteal amputation, and is a simple and effective means of preventing the development of osteophytes, which are a common cause of painful stumps. (If the periosteum and marrow are removed for too great a distance from the end of the bony stump, necrosis of the terminal portion of the bone may occur.)

The Bunge aperiosteal method of treating the bone stump, together with the proper treatment of the nerves to prevent neuroma formation, and the Hirsch method of after-treatment have proved of great value in accomplishing painless and good end-bearing stumps.

The sharp edges of the bone may with advantage be smoothed off by the use of a bone-cutting forceps. This applies particularly to the linea aspera.

Finally, the two flaps of muscle are sewed together with interrupted chromic catgut stitches, beginning so as to first cover the end of the bony stump, and progressing in layers till the skin is reached. Before closing the skin a rubber drainage-tube is ordinarily placed transversely across the muscle so as to protrude from either end of the stump. Lastly, the skin is closed with a running silk suture or with interrupted stitches.

The stump is covered with a copious dressing which is held in place by strips of adhesive plaster which extend well up on to the hip and one or two strips placed circularly about the stump. These are applied with the stump well flexed. Over this a gauze spica is applied. This passes about the pelvis and holds the stump flexed at the hip.

Postoperative Routine Care of the Amputation Stump.—When the patient is returned to bed, the flexed stump is supported upon a pillow. As this position tends to favor flexion-contracture, which is the type of contracture that naturally tends to occur, it is well to remove the pillow and allow the stump to remain extended for a short time once or twice a day. At this time in order to further counteract the tendency to contracture in flexion and abduction, the stump should be passively extended and adducted to the full limit. If a drain has been used, it is ordinarily removed about the third day or as soon as drainage ceases. The stitches are ordinarily removed at about the seventh to the tenth day.

The measures suggested by Hirsch, or slight modifications of these, are a most important part of the after-treatment and have long been recognized as being of great value in obtaining end-bearing stumps. Their practical value was conceded by those taking part in the discussion of amputations at the Fourth International Surgical Congress held at New York in 1914, and their value was demonstrated beyond question by the vast clinical experience during the war.

The Hirsch method of after-treatment has for its aim the proper maintenance of the circulation and tone of the muscles and the hardening of the tissues at the end of the stump, so as to make end-bearing painless. The treatment is begun even before the wound is healed and consists of measures employed while the patient is still confined to bed, and those employed as soon as the patient is able to be up and about.

As soon as the stitches are removed the stump should be massaged for ten to thirty minutes once or twice daily. At first this massage is very light. It is increased in depth and force as rapidly as the tolerance of the stump will permit. In order to harden the skin at the end of the stump the patient is given pressure exercises. The patient presses the end of the bandaged stump against some rigid obstruction, such as a box placed in the bed, or against the mattress. At first this pressure is made for a few minutes only, several times a day. If this is well borne, the pressure exercises are increased to five or ten minutes every two hours, and later every hour. After each pressure exercise the patient actively moves the stump in all directions as far as he is able to, giving particular attention to full extension and full adduction. Later, when the strength of the muscles has increased, resistance exercises are begun in order to prepare for the early use of a temporary artificial limb. The circulation of the stump is promoted by the use of warm baths or electric-light baths, or by the use of the contrast bath. This consists of alternately plunging the stump into a pail of very cold water and then into a pail of very hot water as rapidly as the patient can do so. This is kept up for five or ten minutes at a time once or twice daily.

As soon as the patient is able to be out of bed the end of the stump is further hardened by beginning end-bearing at once. This is accomplished by having the patient stand beside the bed on his sound leg, supporting himself with his hands on the mattress, resting the end of the stump gently upon a pillow placed on a stool of suitable height. As soon as sufficient progress has been made to do so, the patient supports himself entirely by standing with one foot on the floor and the stump resting on the stool. The thickness of the pillow placed on the stool is gradually decreased. A little later the patient gently pounds the end of the stump against the stool in order to prepare the stump for the use of a temporary artificial leg, which is applied as soon as the patient is able to make these pressure exercises against the stool with a moderate degree of force.

The patient walks with his temporary artificial limb as early as possible.

The following method of constructing a temporary artificial leg, which is a modification of the one suggested by A. Ritschl, published in 1915,[1] and the one published from the office of the Surgeon-General, U. S. Army, in The Military Surgeon, vol. xlii, No. 4, April, 1918, can be carried out with ease and without any special equipment.

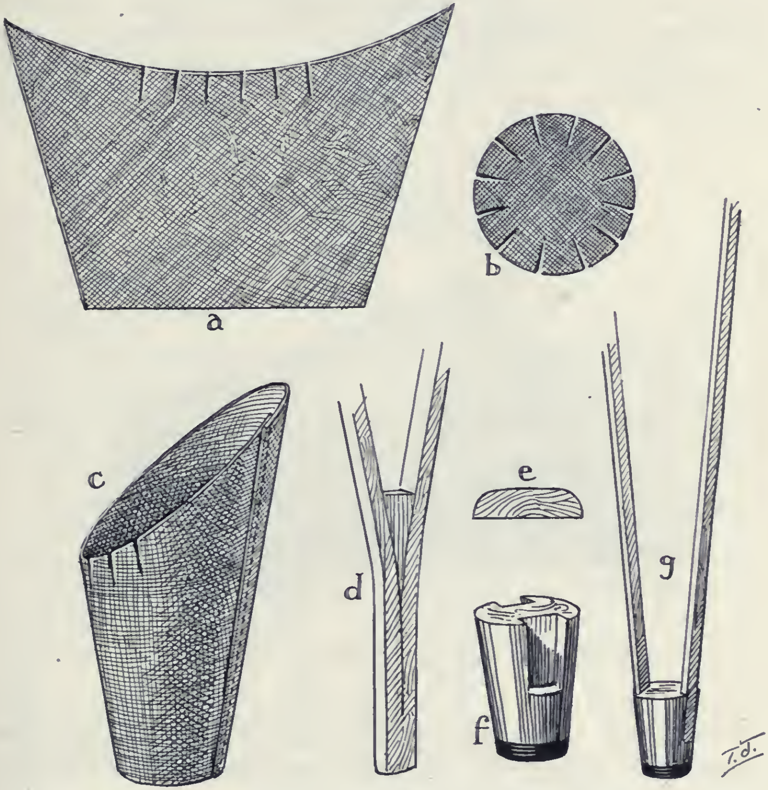

Fig. 471.—Diagram, slightly modified, from The Military Surgeon, April, 1918.

Method of Constructing Temporary Artificial Limb.—Two pieces of white pine, each 36 inches long, $1\frac{1}{4}$ inches wide, and $\frac{3}{8}$ inch thick are rounded on two edges (Fig. 471, *e*). A truncated cone of white pine, 4 inches long, $2\frac{1}{2}$ inches wide above and 2 inches wide below, is used for a foot-piece (Fig. 471, *f*). Two grooves are cut into opposite sides of this so that 2 inches of the side-bars may be fitted flush and screwed into this foot-piece (Fig. 471, *g*), which is completed by a disk of rubber attached to the bottom. The side-bars are cut so that when attached the total length of the artificial limb will equal that of the other leg with the shoe on. The lateral side-bar is 2 or 3 inches longer than the medial side-bar. A few carpet tacks are driven into the outer surface of the upper end of each side bar, allowing the heads of the tacks to project $\frac{1}{8}$ to $\frac{1}{4}$ inch. A piece of saddler's felt $\frac{1}{4}$ inch thick is cut to fit the stump (Fig. 471, *a*) according to the following measurements: circumference of the thigh at the perineum; oblique circumference from perineum downward over the great trochanter; circumference at lower end of stump; length from perineum to end of stump; length from great trochanter to end of stump; allowing 2 inches additional above to be turned over as a cuff. The upper edge of the felt is notched (Fig. 471, *a*). The felt is carefully fitted to the stump and sewed (Fig. 472). During the sewing the felt is held well up against the tuberosity of the ischium by means of a bandage held by the patient (Fig.

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[1] Amputationen und Ersatzglieder an den unteren Gliedmassen, A. Ritschl, Ferdinand Enke, 1915.

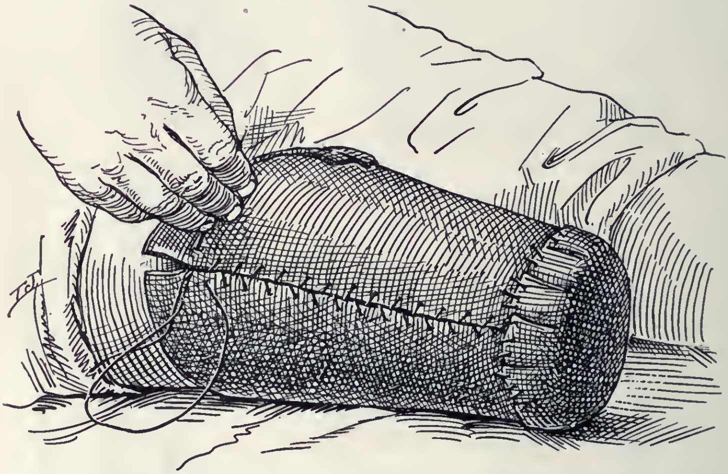

Fig. 472.—Diagram showing method of covering stump with felt.

473). The upper 2 inches of the felt is turned down over the bandage to form a cuff.

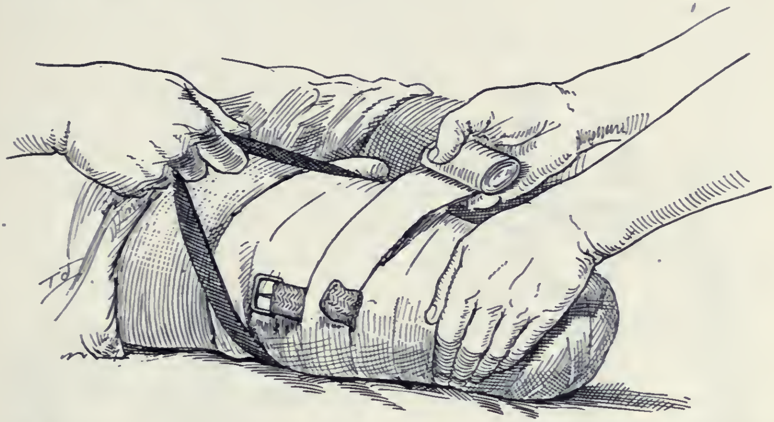

Fig. 473.—Diagram, slightly modified, from The Military Surgeon, April, 1918.

While the patient holds the felt in this manner a plaster-of-Paris bandage 5 inches wide is applied around the stump for its entire length, being careful not to include the felt cuff (Fig. 473).

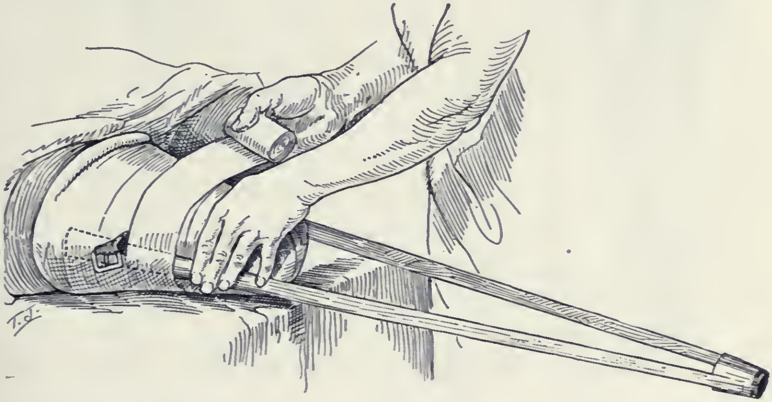

Fig. 474.—Diagram, slightly modified, from The Military Surgeon, April, 1918.

Meanwhile an assistant prepares a molded plaster splint 5 inches wide and as long as half the circumference of the upper end of the stump. This is now applied to the medial side of the upper end of the stump and is held up against the ischium by means of the same bandage held by the patient to support the felt, and in the same manner. The upper 1 inch of this molded plaster-of-Paris splint is turned down over the bandage as a cuff, and this reinforcement is molded to fit accurately, special care being taken that it is carefully molded about the tuberosity

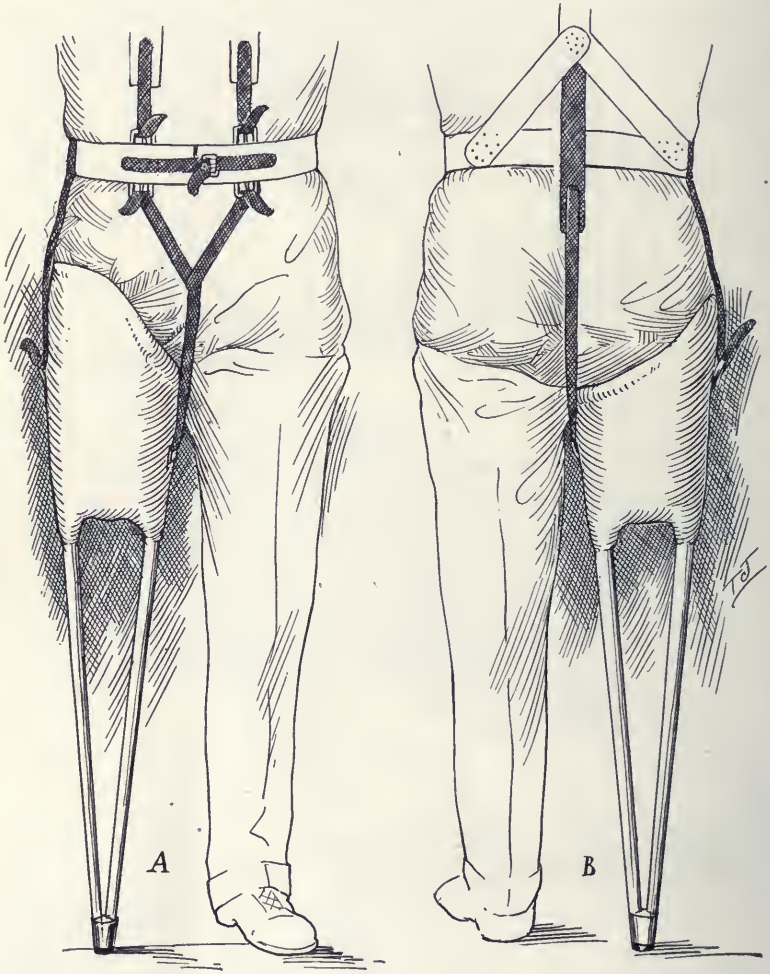

Fig. 475.—Diagram, slightly modified, from A. Ritschl, 1915, and The Military Surgeon, April, 1918.

of the ischium, as this is the point that supports most of the weight. In front it should sink in a gentle curve about 1 inch below the horizontal ramus of the pubis, as the available surface of the horizontal ramus of the pubis is unsuited to bear weight because it is narrow and ridge-like and the skin over it is particularly delicate.

A short piece of webbing, 1¼ inches wide, with a buckle attached to one end is placed on the lateral side of the artificial limb (Fig. 473), and a similar short piece of webbing with a pulley attached is placed on the medial side. These are fixed in place by four or five turns of the plaster bandage (Fig. 473). Then the lower free end of each strap is doubled back and covered in with further turns of the plaster bandage. These two straps are so placed that they are entirely covered except the buckle on the one and the pulley on the other (Fig. 474). These straps are later fastened to the device suggested by Fiedel (Fig. 475). This method of supporting the medial side of the artificial limb is of particular advantage because it allows complete flexion and extension and at the same time holds the leg firmly in place.

The side-bars are now fastened on by two or three plaster bandages (Fig. 474) and the end of the stump covered in sufficiently to bear the patient's weight. After the plaster has set the temporary artificial limb is removed, the upper margin trimmed, and the felt cuff turned down. It is put in a warm place, where it is left until it is dry and hard. The felt cuff is now glued down and the artificial limb is ready to wear.

The patient walks with this temporary artificial limb as early as possible, and its use is continued for three or four months. It is not until the end of this time that the patient should be fitted with a permanent artificial leg.

CLINIC OF DR. EDWARD LYMAN CORNELL

CHICAGO LYING-IN HOSPITAL

TRANSPERITONEAL CESAREAN SECTION

Summary: Recurrent attacks of vaginal bleeding six weeks before term in a patient whose pregnancy up to that time had been apparently normal. Delivery by transperitoneal cesarean section the safest method of procedure in this particular case. After-history.

PATIENT No. 13,777, referred by Dr. Sidney Klein, age twenty-eight years, para I, entered the Chicago Lying-in Hospital September 13, 1920. She gives the following history:

The menses began at twelve and a half years, were regular, four to five days in duration, without pain. The last menstrual period was December 29, 1919. The patient had been feeling well up to six weeks ago, at which time she had vaginal bleeding. She was kept in bed and the bleeding stopped in about a week. From that time until September 11th she has been comfortable. On September 11th the bleeding recurred. It was not profuse, just a staining. On the 12th it became more pronounced, and on the 13th she entered the hospital.

Previous History.—Measles in childhood; appendectomy in 1910; tonsillectomy in March, 1919.

General examination, including heart and lungs, was negative. The urine throughout the pregnancy has been normal. The blood-pressure has never been over 120 systolic. The pelvic measurements are:

I. Sp., 27; I. Cr., 26; Bi. tr., 30; Baud., 19; Tub., 8½; C. D., 13; C. V., 11.

The pelvic inclination is somewhat exaggerated and the edges of the membranes near the placental site are palpable. The placenta is on the posterior wall of the uterus. The baby's weight is estimated at 7 pounds. The diagnosis of position was occiput left transverse.

The patient's stay in the hospital until October 2d has been uneventful except for the fact that there has been more or less bleeding. Recently rather large clots have been noticed. On October 2d at 4.30 A. M. the patient complained of having pains at ten-minute intervals. The pains gradually increased in severity during the day, and at 8.40 P. M. the bag of waters ruptured spontaneously. The patient complained of being tired, and morphin, gr. $\frac{1}{6}$, with scopolamin, gr. $\frac{1}{200}$, were given. The effects of this lasted until 2 A. M. October 3d. The pains then became stronger. With the rupture of the bag of waters the head descended somewhat and the bleeding was lessened. The pains gradually increased in intensity and frequency, and yet there was very little effect upon dilatation and descent of the head. The patient's temperature rose from 98° to 98.8° F. and pulse from 90 to 118. Previous to this time throughout her stay in the hospital her temperature has been normal, but her pulse has been somewhat rapid, ranging between 90 and 100.

October 3d at 9.30 A. M. a rectal examination showed the cervix to be rather thick with 5½ cm. dilatation. The head was not engaged and the parietal bones overlapped. The fetal heart tones were 156. At 4 P. M. there was 6 cm. dilatation. The cervix was still thick. The head was not engaged and the fetal heart tones were 160.

At 7.30 P. M. I was asked to see the patient. At this time I found that the cervix was thick (edema), with 4 cm. dilatation. The head was not down to the spine. The posterior parietal bone presented, with much overlapping. The head was in the transverse diameter and could be easily moved out of the pelvis. Grasping the head through the abdomen, it could not be pushed down into the pelvis. The promontory was easily felt per rectum. The pains have practically ceased in spite of the use of quinin. Bandl's ring is quite pronounced. The patient's temperature is 98.6° F., pulse 118, respirations 28. She is very restless and beginning to show signs of exhaustion.

To sum up: We have here a patient who has been given the test of labor for thirty-nine hours, who has had morphin and scopolamin once, whose temperature is gradually increasing, as is the pulse; the bag of waters has ruptured and the liquor amnii has drained out; she has a generally contracted, flat pelvis, and, as you can see, she is a short, rather fat woman. If you will look at her arm you will notice that all the bones are short. She has had one vaginal examination in the hospital and eight or nine rectal examinations. She has a low insertion of the placenta. The head is not engaged; the baby is not large; the cervix is not dilated. Can delivery be accomplished from below if we attempt to use forceps? We cannot attempt to do a forceps delivery unless we should decide first to do a vaginal cesarean section. Then it would mean that we would have a case of forceps on a floating head through an unprepared vagina and through a contracted inlet. Our chances for delivering a live baby without considerable damage to the baby would be slim, to say the least. If the head was pulled through this canal we would probably get a skull fracture or at least a brain hemorrhage, with its resulting complications. From the fact that her pulse has increased and her temperature has risen slightly, we suspect that infection is beginning, and with all the traumatism that would follow vaginal delivery the chances for puerperal sepsis are good.

The next method of delivery to be thought of is podalic version, bringing a foot down and allowing the breech to dilate the cervix. This is not advisable in this case because, first, we have no liquor amnii and the uterus is grasping the fetus rather firmly and the lower uterine segment has been thinned out to the point where Bandl's ring is quite pronounced. It is possible occasionally to turn these babies without getting a ruptured uterus, but unless done by an expert it is very dangerous. Even if we could turn the baby, we would still have a contracted inlet through which to deliver the head. The fact that the parietal bones are overlapping markedly indicates that the inlet is more contracted than our measurements would lead us to believe.

The method still remaining of delivery from below consists in craniotomy. No one these days wants to do a craniotomy on a living child.

Two other methods of delivery present themselves—one, the classical cesarean section, and the other, the transperitoneal cesarean section. The classical cesarean section is out of the question in this case because of the fact that the bag of waters has been ruptured so long and because the temperature and pulse have increased. The risk to the mother is too great. Transperitoneal cesarean section can be done with the least amount of risk to the mother and practically no risk to the child. We have, therefore, a patient whose chances for delivery from below with a live child are very precarious. The only method available is a vaginal cesarean section and high forceps, with all the trauma that usually goes with these cases. The mother's chances of infection and chronic invalidism are greater than in delivery from above. We will deliver this patient by a transperitoneal cesarean section.

The patient is prepared according to the method described in a previous clinic.[1] An incision is made in the median line from the pubes upward about 12 cm. We go through the fat, fascia, and peritoneum. Care must be taken that the bladder is not injured in cutting the peritoneum, as one must remember the bladder is drawn up out of the pelvis during pregnancy. The peritoneum over the uterus is cut transversely 1 cm. above the junction of the bladder and the lower uterine segment. The bladder is then peeled from the lower uterine segment. The peritoneum on the uterus is stripped up as far as possible, at least to the junction of the lower uterine segment with the body of the uterus. We then incise the cervix in a longitudinal direction. This incision is approximately 10 cm. long, and we find that there is a mucopurulent discharge exuding. Considerable care is exercised in mopping this material without contaminating the skin wound and the peritoneal cavity. It is possible to keep this material confined in this case because the liquor amnii has been drained. We will take a sample of this exudate in a small syringe and give it to Dr. Falls, who will stain and culture it. The baby's head is delivered with forceps. You will notice that the cord is around the neck three times. It is lifted over the

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[1] Surgical Clinics of Chicago, 4, 1, p. 195, February, 1920.

head in the usual manner. The parietal bones are overlapping approximately $\frac{1}{2}$ cm. The child is in good condition, so there is no need to hurry the delivery of the shoulders and body. One must remember that in delivering the shoulders considerable damage can be done to the lower uterine segment by rough handling. The cord is cut between clamps and the baby is passed to the assistant. You will notice that the cry is vigorous. We caution the assistant to pay particular attention to the eyes in this case. He will use several drops of 1 per cent. silver nitrate, allowing it to remain in the eye. The baby's cord will also be carefully disinfected with 1 : 5000 bichlorid of mercury. There is no need to hurry the delivery of the placenta. The patient is given 1 c.c. of pituitrin and 1 c.c. of ergot. It is now three minutes since the baby was born and the uterus is contracting well. If you look through the uterine incision you will see that the placenta has become loosened and is bulging into the wound. It is located on the posterior wall of the uterus, well down in the lower uterine segment. Gentle pressure over the fundus *through the abdominal wall* (not inside the abdomen) causes the placenta with the membranes to be extruded from the uterine incision. We now grasp the placenta and gently extract it. We find that the lowermost edge of the placenta contains an old clot which is partly organized. It is, therefore, probable that the profuse hemorrhage earlier in pregnancy was due to placenta prævia marginalis.

The operators will now sterilize their gloves by using concentrated lysol solution followed by sterile water and 1 per cent. lysol solution. The uterine incision will be closed in the usual manner.

Dr. Falls reports that there is a Gram-positive diplococcus in the smear. There are no chains, but there are leukocytes.

The question now arises, Shall we use a drain or shall we close the wound tightly? We know that the peritoneum in the pelvic region is capable of handling severe infection many times without causing the death of the patient from peritonitis. We have this patient in the hospital under constant observation, and I feel that under the circumstances it would be best to close this abdomen tightly. We will, therefore, follow that procedure. After the uterus is closed we find that the promontory is very easily felt and is overriding the inlet. This undoubtedly accounts for the dystocia. It is felt through the uterus. The hand must never be passed behind the uterus in cases of suspected infection.

The mother and baby left the operating room in excellent condition. The baby weighs 2805 gr. and is 48 cm. long. The measurements are:

Biparietal, 8; Bitemporal, 9; Subocc. breg., 10; Occip. front., 11; Occip. ment., 13½; Bisacr., 11; Bisiliac, 8.

After-history.—The cultures made by Dr. Falls from the solution removed at operation showed staphylcocci. No growth was found at the end of twenty-four hours, and it was only at the end of forty-eight hours that the broth showed signs of growth.

After operation the patient's pulse was 122 and temperature 99° F. The second day the temperature rose to 101.2° F., and then gradually came down until the seventh day, when it reached normal, and remained there during the rest of her stay in the hospital. The pulse gradually came down, being below 90 from the fifth day on. Several times during her stay in the hospital of fifteen days she had attacks of severe pain in the gall-bladder area. The stitches were removed on the ninth day. The wound was in very good condition with the exception of one stitch, which showed a small area of infection. This infection did not extend beneath the skin.

This case demonstrates one of the possibilities of the transperitoneal cesarean section.

CLINIC OF DR. RALPH BOERNE BETTMAN

MICHAEL REESE HOSPITAL

THE REMOVAL OF EMBEDDED NEEDLES IN BROAD DAYLIGHT WITH INTERMITTENT FLUOROSCOPIC CONTROL

Summary: Difficulty of removing needles embedded in hand or foot. Removal greatly facilitated by use of a head fluoroscope with intermittent screen control.

ALL surgeons know from sad experience that the removal of a needle embedded in hand or foot, although apparently a simple procedure, is, in reality, a most difficult one.

The stereoscopic *x*-ray pictures, the screen localization, seem to determine the position of the foreign body to an exactitude, and yet the small incision made over the location of the needle often fails to reveal it. A larger incision is made, and still no needle discovered. The *x*-ray plates are again consulted, the wound further enlarged, the margins sectioned, and finally, just as the surgeon is about to despair, the needle is discovered embedded in tissue hidden under the retractor, or on the other side of a fascial plane, or just to this or that side of the wound. The frequency of such occurrences has made me wonder why fluoroscopic control is not more often employed.

In 1916, while working with Dr. J. Rilus Eastman in a base hospital, numerous cases with retained shell fragments were admitted to the wards. We found that the difficulties experienced in removing embedded needles in civil practice were being repeated here with these small metal bodies. Although the fluoroscopic localization methods and the roentgenograms placed our object to within a millimeter or two, the removal thereof was, as a rule, a long and tedious process. The first incision altered the relative position of the skin marking, it was difficult to place the part of the body operated upon in the exact position adopted during the localization, the slight oozing veiled the object, etc. We finally were forced to adopt the common technic of general anesthesia—large incisions and long protracted search. It occurred to us that the removal of these foreign bodies in the *x*-ray room under the fluoroscope would simplify matters, but we soon found that it was no easy task to control the anesthesia, maintain asepsis, and preserve structures of anatomic importance in a dark room or in a room alternately darkened and lighted. An ideal method seemed to be a combination of the two, and so the monocular fluoroscope of Grashey was put to the test. A surgeon using Grashey's monocle loses half his sight, nine-tenths of his stereognostic sense, and gains but little fluoroscopic information. After many trials I finally constructed an operating fluoroscope similar to the one illustrated. With this fluoroscope operating in broad daylight and having at hand the means of obtaining fluoroscopic aid without danger to asepsis, without changing the patient or room, we found that we could remove embedded shell fragments through small incisions with a speed and precision which soon established the value of this method.

The French surgeons working with the bonnet fluoroscope of Dessane had the same experience, and the method of intermittent screen control in removing shell fragments was widely adopted. Any A. E. F. men who had the good fortune to see their work will testify to the ease with which even small, firmly encapsulated fragments were removed. Holzknecht, in Austria, constructed a very elaborate device for *x*-ray control in removal of foreign bodies in daylight. In his method the surgeon does not have the fluoroscopic vision.

It is surprising that despite the fact that the advantages of intermittent screen control in the removal of foreign bodies were so definitely proved during the war, wider application of this procedure should not have followed in civil surgery. To urge the adoption of this method in civil practice I do not hesitate to repeat what already has been told.

The operating fluoroscope consists of a small fluoroscope similar to the hand fluoroscope in common use. It fits snugly against the operator's forehead and cheeks, so that when the screen is down it is light-tight. It must weigh as little as possible. The straps over the head are adjustable. The screen is on a hinge and is held closed by a spring. When the screen is open the same spring holds it open. At the same time a bit of ruby glass is raised before the operator's eyes. This ruby glass is to preserve the pupillary accommodation. A young man or one with a very adaptable power of accommodation to light can dispense with red glass.

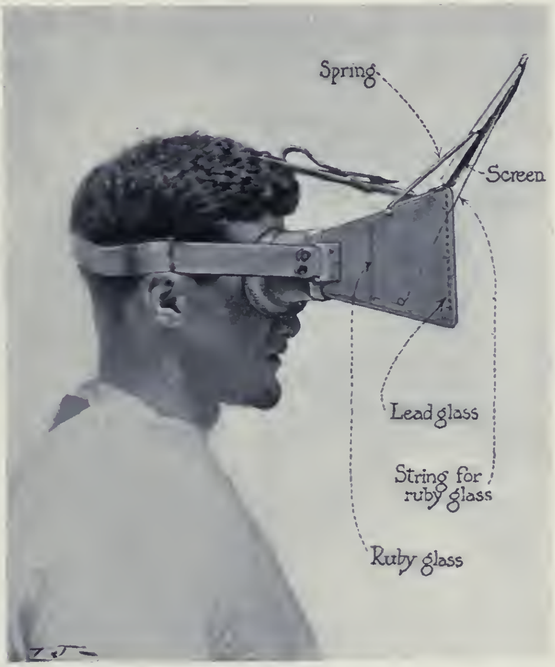

Fig. 476.—Operating fluoroscope with screen open. The surgeon is looking through a thin piece of ruby red celluloid which has been pulled in front of aperture by raising the screen.

Lead glass, the same as used for the fluoroscopic screens in common use, is placed at the base of the hood, so as to protect the operator. The screen is the usual fluoroscopic one.

When the screen is opened the surgeon has direct vision. When the screen is closed, no matter how brightly lighted the room be, the surgeon can see the fluoroscopic images exactly as if he were in a dark room using an ordinary fluoroscopic screen.

In order that the surgeon may himself regulate the position of the tube and the size of the aperture of the diaphragm without breaking sterile technic, or having to use his hands, wooden horseshoe-like brackets, which can be manipulated by the knees, are fastened to the handles of the tube box controls.

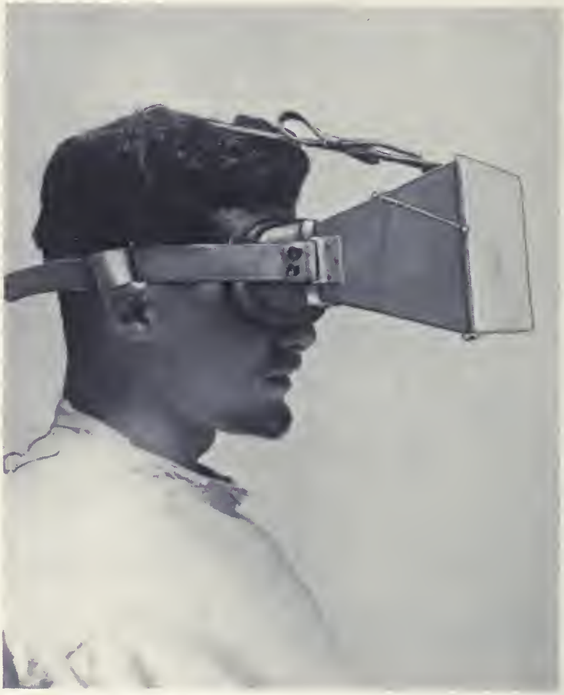

Fig. 477.—Operating fluoroscope with screen closed. The surgeon is looking at the fluorescent screen.

The usual fluoroscopic table with the under table sliding tube box, installed in every *x*-ray department, is amply sufficient. In industrial plants or wherever a large number of foreign bodies are being removed, it might be advisable to raise the height of the table to that of the average operating table.

The French bonnet is very similar to the instrument described. In the Dessane fluoroscope the entire lower part of the bonnet is raised instead of the screen only.

A very practical operating fluoroscope can easily be constructed out of the ordinary hand fluoroscope. The bottom (the screen) is detached and then reset on hinges, and springs are attached to the screen and the box, so that the screen will be held open or closed. Straps are attached which will fit the surgeon's head.

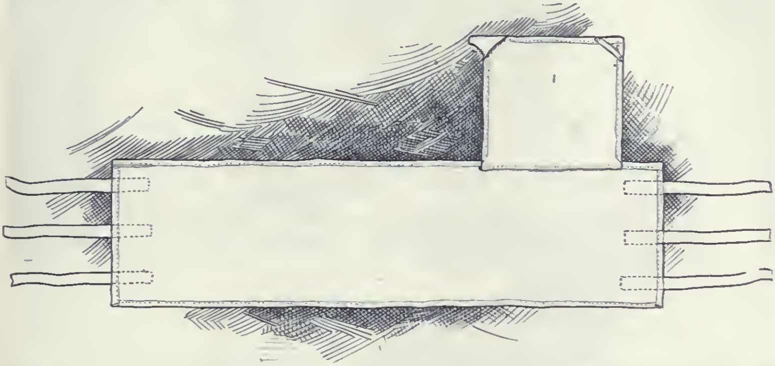

Fig. 478.—Sterile shield used to cover operating fluoroscope during the operation.

The first patient upon whom I am going to operate today has a broken needle in the palm of her right hand between the heads of the second and third metacarpals. Six days ago while cleaning a table in a millinery establishment she ran the blunt end of a needle into her hand, the point projecting. She drew the needle out, noticed that the eye was missing, but concluded that the needle had probably been a broken one.

The hand continued to hurt, and now, six days later, she has come to us. The hand is not swollen or reddened. The motion of the fingers is normal, but extreme flexion and extension cause a sharp pain deep in the palm. The fluoroscope reveals the end of a needle lying obliquely in the interspace between the second and third metacarpals and ventral to the bones. By carefully observing the needle as I rotate the hand I see that the radial end of the broken needle is nearest the skin.

The fluoroscopic table is our operating table. My assistant and myself are scrubbed as if in the operating room and the field of operation is prepared with the usual care and draped with sterile linen in the usual manner. I am wearing the fluoroscope which the nurse has covered with a sterile cloth. As you see I have taken out the ruby glass. My eyes accommodate very quickly to light, or I might better say dark, and in this particular case where the part upon which I am operating is comparatively thin and where the foreign body casts a marked

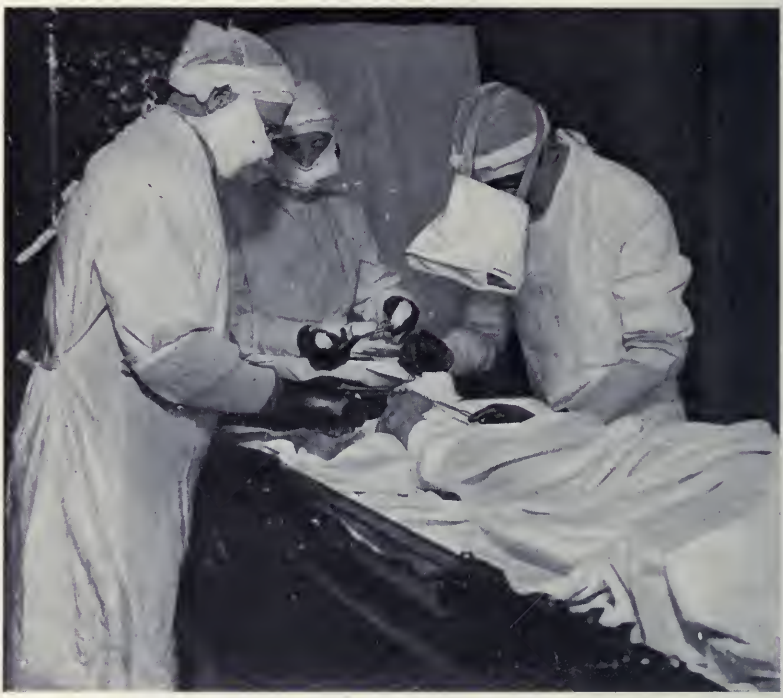

Fig. 479.—Showing the method of operating with the aid of the operating fluoroscope. The incision has been made and the surgeon is observing the position of the needle in relation to the tip of the probe which he has placed in the depth of the wound.

shadow, I have no trouble in distinguishing the fluoroscopic images.

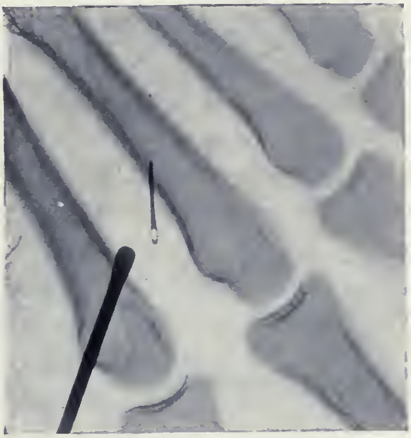

Fig. 480.—Fluoroscope views in removing a needle with intermittent screen control. The probe is in the depth of the wound. The surgeon notes the relative position of the needle.

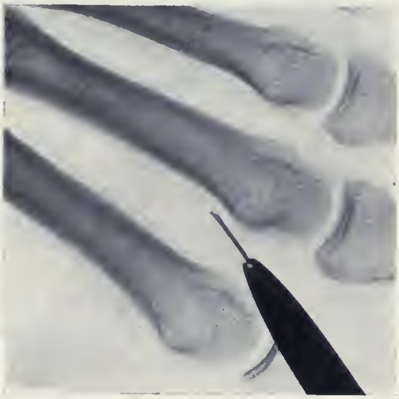

Fig. 481.—The needle has been grasped with a hemostat and is being extracted.

A cuff of a blood-pressure apparatus has been put about the arm to act as a constrictor. I close the screen, step on the pedal which controls the current to the tube. I now see the fluoroscopic image of that part of the hand exposed and can readily distinguish the needle. I will place the point of the scalpel over the most accessible end of the needle.. I shut off the current, raise the screen, and mark the point where my knife is resting, knowing positively that the end of the needle lies below it.

After infiltrating with $\frac{1}{2}$ per cent. novocain solution, I am ready to make my incision, which will be a small one over the upper end of the needle. I can make my incision and do my dissecting with due regard to the preservation of the tissue instead of cutting down perpendicularly to the axis of the needle, regardless of the anatomy, with sole intent of finding the foreign body. I am down to the palmar fascia, but before I proceed will reorientate myself. I put the probe in the depth of the wound, close the screen, turn on the current. I can see my probe is proximal to the needle, that is, toward the wrist. When I turn the hand sideways I note that the end of the needle is still a little deeper than the probe.

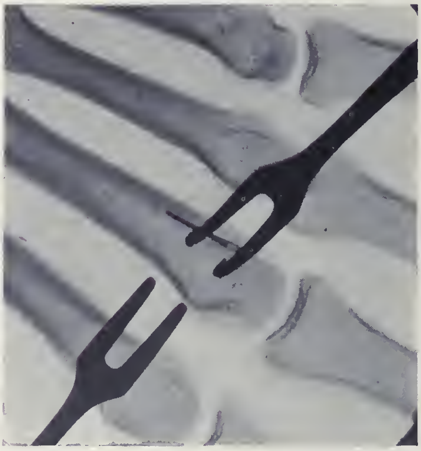

Fig. 482.—The surgeon has made a large wound and still is unable to find the needle. The needle is lying in the wound margin and is being pulled out of its former position by the retractor. This is a frequent occurrence, and without the aid of the fluoroscope would be very perplexing.

With this additional information I proceed to dissect through the fascia, extending the incision slightly toward the fingers. The patient is complaining of the pressure of the tourniquet, so while the cuff is deflated I will make another screen observation. This time I see that the probe shadow is over the shadow of one end of the needle, and turning the hand sideways I can see that I am almost touching it.

The cuff is now infiltrated; gently, very gently swab out the wound, cut down at the upper angle, and here you see is my needle. I will grasp it and withdraw it. In order to make sure that this time the entire embedded body is being removed I close the screen again, turn on the current, and observe that no foreign body remains.

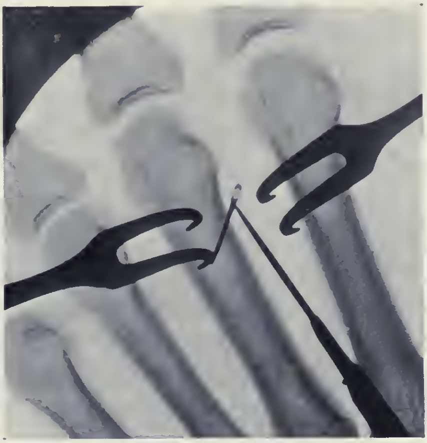

Fig. 483.—The retractors have been replaced and the surgeon is now cutting down directly upon the needle. *Note:* In Figs. 480–483 the diaphragm is set so that the rays fall entirely within the area of the screen—the area of lead glass protection.

Had I been operating in a field of less anatomic complexity than the hand—say the buttocks—I would have made my skin incision as I have done here, and then by blunt dissection would have worked down toward the foreign body. When near it I would have closed the screen and with a long curved forceps have dissected directly to my object under the fluoroscopic control. In such a case, where I could not have rotated the part, I would have gained the information regarding the depth of the object by sliding my tube up and down and noted the relative duration of the shadows of the probe and object. The shadow of the object nearer the tube naturally moves further than the shadow of the object nearer the screen.

The second case is a man who day before yesterday while walking barefoot about the room stepped on a needle. The needle broke off, leaving a portion embedded in the foot. The fluoroscope shows the fragment embedded in the sole of the right foot lying at an angle of 45 degrees to the axis of the fifth metatarsal and just proximal to the phalangeal head. When the foot is turned sidewise the needle can be seen lying in a plane parallel to the margin of the foot and just plantar to the metatarsal bone. The outer margin of this part of the foot is slightly reddened, swollen, and tender. There appears to be an inflammatory reaction.

I am going to make my incision through this tissue so that I can leave it open for drainage. Place the patient on his left side, cover him with a sterile sheet, prepare the field of operation, and clean ourselves as if we were in the operating room. This time I am going to let my assistant wear the fluoroscope. He has now closed the screen, has turned on the current, designating the position of the needle with a probe.

I now inject the novocain, blocking first above the region. I have made a larger incision than necessary for the simple extraction of a needle, dissected down approximately to the place where the needle should be, and now I am going to ask for fluoroscopic guidance.

I leave the knife in the wound and my assistant will give me the direction of the needle relative to the position of the knife.

ASSISTANT: "With the foot in this position the blade of the knife is very slightly below the needle (plantarward)."

I am now turning the foot so that the fluoroscopic screen shows the foot in the plantar-dorsum plane.

ASSISTANT: "The point of the knife is proximal, that is, heelward, to the outer end of the needle."

I now turn the foot back again and resume the search. I know that my needle lies a little dorsal and a trifle distal of my incision, so that I will extend the wound slightly toward the toes and cut away from the sole of the foot. I am sure I am deep enough now, and think I am far enough toward the toes. I will try another orientation, first, with a lateral view, and second, in the anteroposterior plane.

Assistant: "The blade of the scalpel is very slightly plantar to the needle. In the anteroposterior plane the shadow of the outer end of the needle merges with the shadow of the scalpel. Kindly withdraw the scalpel a little. Now the shadow of the outer end of the needle is separated from the scalpel. Please put the scalpel down to the depth of the wound the way you had it before. The shadow of the scalpel overlaps that of the needle by about one-half the width of the blade of the scalpel."

The needle lies in the upper margin of my wound. I have returned the foot to the lateral position and will cut into the dorsal wound margin. Here is the needle just above where I was before. To make sure that I have extracted the entire needle we will make a fluoroscopic control.

Assistant: "No foreign body to be seen."

I will insert a small gutta-percha drain, leave the wound open, and apply hot, wet dressings.

A word as regards the dangers: For some reason or other it seems the roentgenologists in our army, who having been just recently instructed in the danger of burns, did most to terrify the surgeon. This dread is unfounded. In the first place, an aluminum filter is used to protect the patient just as in the usual fluoroscopic examination. In the second place, by using the fluoroscope intermittently as a control the total length of exposure is usually, as you see, very much less—one-half or one-third the length of a single routine gastro-intestinal examination. As regards the danger to the surgeon and assistants, this is also nil as long as ordinary precautions are used. The surgeon who observes and removes an occasional foreign body is infinitely less exposed than the ordinary radiographer. The lead glass protects an area the size of the screen. The diaphragm must always be so adjusted that the cone of light falls entirely within the screen. The surgeon's hands need never be exposed.

While the x-ray is being used, only a long probe need be held in the wound. When the surgeon is endeavoring to reach the object by blunt dissection, a curved forceps can be used.

In summary: The apparatus consists of a light fluoroscope which can be fitted to the head of the surgeon or his assistant. When the fluoroscope is open the operator has direct vision. When the fluoroscope is closed he is looking into a light-tight box and is enabled to control the position of the needle by means of the fluoroscopic vision.

The x-ray room, provided there is good light, is a suitable operating room, and the usual fluoroscopic table, found in any hospital, an operating table.

The object is removed in bright light, thus the anatomy of the part can be preserved, asepsis maintained, the patient kept constantly under observation, and no time lost.

Local anesthesia usually suffices.

The incision is small and is made with deference to the anatomy of the part. The tissue is not mutilated by a large scar.

There is no danger of x-ray burns or irritation, either to the patient or the surgeon.

The technic is simple.

This article is a plea for a wider use of the method of intermittent screen control in removing embedded needles, pins, or other foreign bodies encountered in civil surgery.

CLINIC OF DRS. GATEWOOD AND L. C. GATEWOOD

PRESBYTERIAN HOSPITAL

SYPHILIS OF THE STOMACH

Summary: Patient giving a history of "stomach trouble" of several years' duration. Report of physical examination and laboratory findings by Dr. L. C. Gatewood. Diagnosis: Syphilis of the stomach. Operation: Posterior gastro-enterostomy, performed by Dr. Gatewood. Discussion on syphilis of the stomach.

THE patient I wish to present to you this morning is a married man, thirty-five years of age, who was admitted a few days ago to the service of Dr. L. C. Gatewood, who will give you the history.

DR. L. C. GATEWOOD: This patient gives a history of "stomach trouble" which began seven or eight years ago with attacks of vomiting. These occurred while eating or immediately after eating. At first intervals of three or four months passed between his attacks, but they have gradually become more frequent, until recently he has been vomiting after three or four meals each week. He never vomits, however, after more than two meals in any one day, and usually but once a day. Vomiting *always* occurs within a few minutes after eating or at times before he has finished his meal.

While he dates the onset of his trouble back a number of years, it has only been during the past seven or eight months that it has been acute enough to partially incapacitate him. There is little or no nausea, and he states that "if food would stay down ten minutes it does not come up." He has never vomited food which remained in his stomach longer than six hours and never a quantity larger than that eaten at the preceding meal. The quantity of food intake and the quantity of vomiting have always been small, as he has not been able to eat "regular size meals" for several months. As soon as he takes a small amount in the stomach he begins to feel full and must stop eating or vomiting will ensue. He has never noticed blood or coffee-ground material in the vomitus. While there is no history of acute pain, he complains of a dull burning pain located in the epigastrium which has been present for the past seven months, recurring regularly either while eating or immediately after his meals. This burning sensation is relieved immediately by vomiting, and otherwise gradually disappears within thirty or forty minutes.

The discomfort is not associated with a desire for a bowel movement, nor is it relieved by defecation. His bowels move daily without cathartics and the stools are usually formed.

He has lost 20 pounds in weight, most of which he thinks has occurred within the past few weeks. His present weight is 118 pounds.

His past history is negative except for an attack of acute appendicitis three years ago, at which time appendectomy was done. He denies venereal disease both by name and by symptoms. He has been married for thirteen years and has 4 children, all in good health, ages twelve, ten, eight, and six. His wife has had no miscarriages.

Physical examination reveals, as you see, quite an emaciated individual about thirty-five years of age. His pupils are equal and react to light and accommodation. There is no edema of the extremities and no general adenopathy. Patellar reflexes are active and the Babinski is absent. The liver margin is just palpable below the costal border and the spleen is readily palpable. There are no abnormal masses to be felt in the abdomen and no areas of localized tenderness or muscular rigidity found.

Upon dilating the stomach with sodium bicarbonate and tartaric acid the lower border of the stomach is found just above the umbilicus and there are no visible peristaltic waves.

Laboratory reports are as follows:

Urine is negative; hemoglobin (Dare) 75 per cent.; erythrocytes 4,400,000; leukocytes 7500; Wassermann 4+. Blood-pressure is 106 systolic and 70 diastolic. The Ewald test meal showed no free hydrochloric acid, total acidity 12, milk-curdling ferments absent, blood and pus absent. These findings I confirmed by repeated examinations. Motor meals were vomited before the expiration of the normal emptying time of the stomach. The stools contained no blood, pus, or mucus.

On fluoroscopic examination the heart and lungs were negative. The barium mixture passed through the esophagus normally without evidence of obstruction or spasm. The patient was able to take only a small amount of the barium mixture and began to complain of a full feeling. On attempting to swallow, more vomiting occurred. At no time could he retain more than 6 ounces of barium without vomiting. This quantity was sufficient to fill the stomach as completely as does 1½ pints in the average case.

The stomach was quite narrow (Fig. 484). There was no filling defect and the walls seemed pliable. The duodenum filled quickly and was abnormally wide. Contrary to the usual findings, the barium suspension was retained a long time in the first and second portions of the duodenum, and increased peristalsis and antiperistalsis were observed. I was able to confirm these findings by subsequent examinations.

To sum up our findings: We have, first, a history of attacks of vomiting; second, loss of weight which has been rapid in recent weeks; third, a palpable spleen; fourth, achylia gastrica; fifth, positive Wassermann reaction; sixth, an abnormally small stomach without filling defect or other demonstrable deformity; seventh, evidence of duodenal obstruction. What pathology will best explain these findings?

The positive Wassermann reaction may be accepted as evidence of lues in spite of the negative history. Is this causal or incidental? In the absence of any other demonstrable cause for splenic enlargement the palpable spleen may well be due to syphilis. Vomiting occurring while eating or immediately after eating, practically without nausea, suggests the so-called nervous or hysteric vomiting, or an obstructive process located relatively high up. Such history is not uncommon in hour-glass deformity of the stomach with a small proximal pouch. It fits well with our finding of a small stomach, particularly with the history of being able to eat only a small quantity. The loss in weight might be due either to the vomiting and limited food intake or to constitutional disturbance from organic disease. The size and form of the stomach suggest at once *linitis plastica*, or leather-bottle stomach. Such a process is, as a rule, either

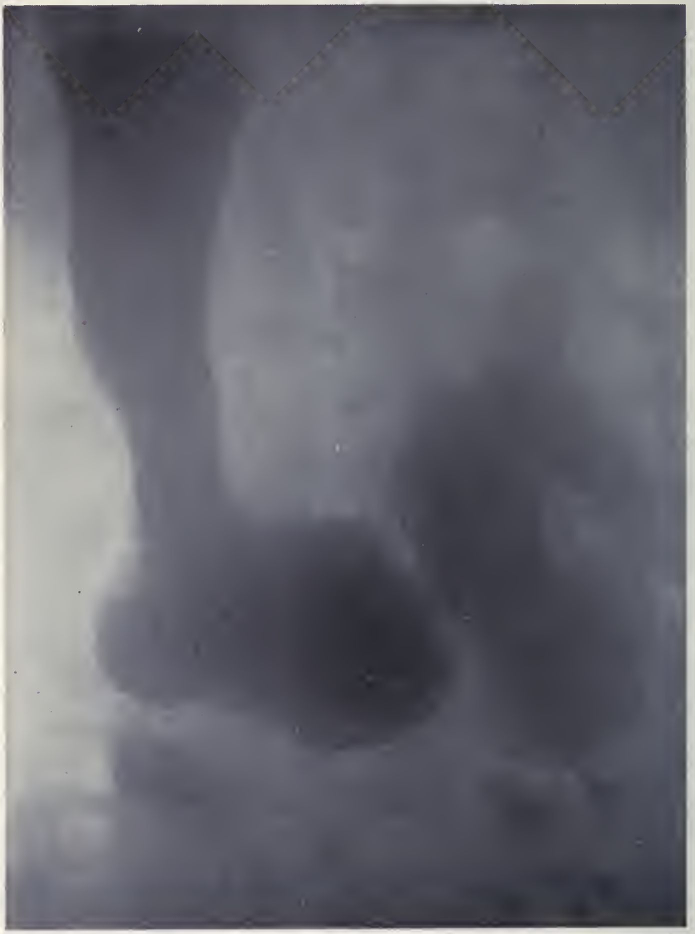

Fig. 484.—This picture is reversed, owing to the way in which it was taken. Note the full duodenum and the narrow, irregular stomach wall.

carcinomatous or luetic in origin. When due to malignancy it does not at all necessarily show a filling defect nor any other fluoroscopic abnormality than those described. Either syphilis or carcinoma would probably show achylia gastrica. The age of the patient—thirty-five—speaks somewhat against carcinoma, but by no means excludes it. The duration of symptoms—seven or eight years—is of more value if we can be sure that the entire picture is produced by the same disease process. The only symptom prior to the past eight months, however, was vomiting—a symptom which may be produced by a variety of conditions—and it would be difficult to be sure that the clinical picture (and the underlying disease process) had not undergone a change within the past year. If we accept the total duration of symptoms as speaking against malignancy, have we sufficient evidence to justify a diagnosis of gastric syphilis?

The subject has recently been discussed rather widely by such men as Eusterman, McNeil, Wile, Carman, and Chase. Chase has summarized the requirements of gastric syphilis as follows:

1. Positive Wassermann reaction.
2. Evidence of syphilis elsewhere than in the stomach.
3. Demonstration of a stomach lesion.
4. Improvement under antisyphilitic treatment.

In the present case a positive Wassermann has been found, and the enlarged spleen may be accepted as probably filling the second requirement. While the form of the stomach may be a congenital anomaly, this is improbable owing to the duration of his symptoms. Antiluetic treatment has not been given, so that the fourth condition has not been fulfilled. In addition, we have found fluoroscopic evidence of a duodenal obstruction, probably in the retroperitoneal portion. Inasmuch as we have repeatedly seen a large duodenal loop which showed increased peristalsis and antiperistalsis and did not empty at any time in the normal way, this finding is not readily explained as a part of any stomach lesion. I have seen it in patients with very large carcinoma of the stomach involving everything adjacent to it. Such an affair, however, does not show the stomach freely movable, with pliable walls, but rather one which is inelastic and fixed to the posterior abdominal wall. This obstruction may be explained by syphilitic involvement of the duodenum or pancreas or adjacent lymphatic structures. A primary lesion in the pancreas, carcinoma, for example, might explain the duodenal obstruction, but would not account for the stomach findings. We would be forced to advance two or more diagnoses to account for all the conditions present. Under the circumstances I believe the findings are best explained on the basis of syphilis involving the stomach and probably also the duodenum or the pancreas in such a way as to produce duodenal obstruction.

Dr. Gatewood: The patient is now anesthetized with drop ether, and I shall make the usual incision a little to the left of the midline just below the ensiform. Owing to the thinness of the abdominal wall due to the loss of weight the skin is very tough and leathery. This condition is characteristic of carcinoma, but is found in other conditions in which there has been a gradual loss of weight. There are no adhesions to the anterior abdominal wall. The omentum, as you see, contains absolutely no fat. I cannot recall having seen a case in which the omentum was as fat free as the present one. The stomach lies almost entirely above the costal margin. It is very small and can be brought out of the wound for examination only with considerable difficulty. The walls are markedly thickened and there is a suggestion of hour-glass formation (Fig. 485) in the fundus. The entire stomach is no wider than my three fingers. There are several whitish scars on its surface. The duodenum is larger than the pyloric end of the stomach. The pylorus is thickened, so that it is difficult to determine the exact amount of obstruction, as I cannot place my finger through the pyloric ring. The pancreas seems to be somewhat enlarged and firmer in consistency than normal. On the anterior surface of the liver are several stellate scars so characteristic of syphilitic hepatitis. There can be no question as to the diagnosis. It is a case of *linitis plastica*, accompanied by syphilitic hepatitis.

What operative procedure shall we follow? A good many cases of syphilis of the stomach are entirely cured on antiluetic treatment, and it is a question whether the operation should not be entirely exploratory. However, this patient has been losing weight very rapidly; he is very markedly emaciated and the medical men have not been able to feed him sufficiently to obtain a gain in weight. As there is very definite evidence of obstruction in the duodenum, an anastomosis between the

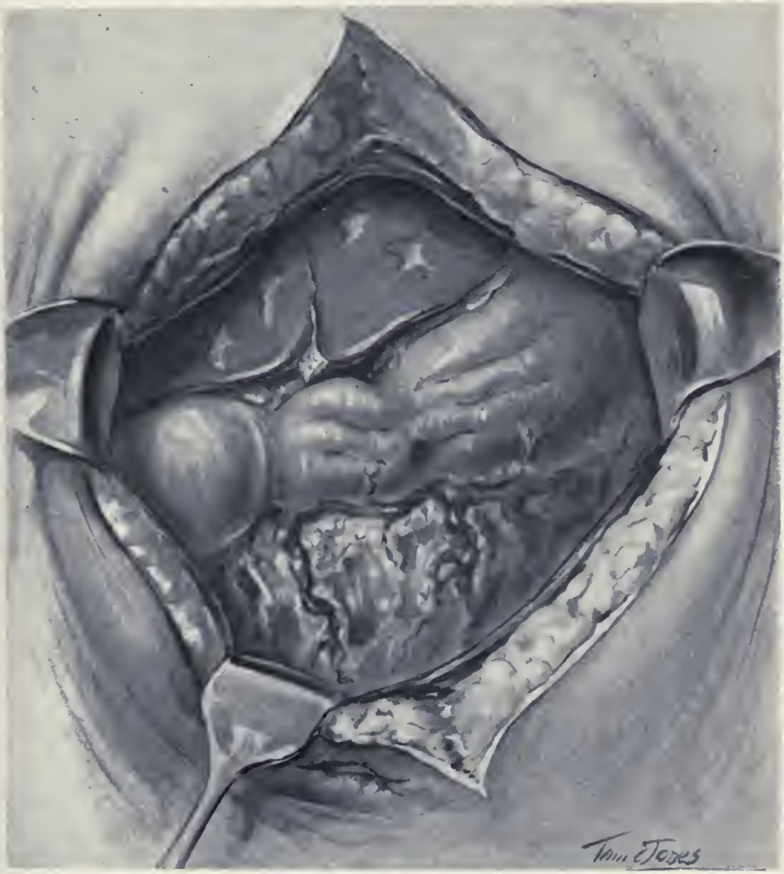

Fig. 485.—Condition found on opening the abdomen. There are no adhesions to the anterior abdominal wall. The stomach lies almost entirely above the costal margin. It is very small, the walls are markedly thickened, and there is a suggestion of hour-glass formation in the fundus. The duodenum is larger than the pyloric end of the stomach and the pylorus is thickened.

jejunum and some portion of the duodenum or stomach seems advisable. A duodenojejunostomy is theoretically the operation of choice. Technically, however, owing to the infiltration of the duodenum and its lack of mobility, this operation would be very difficult. I shall, therefore, do a posterior gastro-enterostomy. This may be exceedingly difficult on account of the infiltration of the stomach wall. I am unable to place a clamp upon the stomach and the operation has to be done without clamps. The usual three-layer gastro-enterostomy is finally done without leakage in a very satisfactory manner. I am now stitching the opening in the transverse colon to the jejunum instead of to the stomach to obviate the possibility of hernia. This is made necessary on account of the friability of the stomach wall. The abdominal wound is now closed in the usual manner without drainage.

The postoperative treatment in this case will not differ from that usually instituted in gastro-enterostomy, except that as soon as the patient has sufficiently recovered from his operation antiluetic measures will be pushed. It will be interesting to observe at a later date whether the stomach regains its normal capacity or not and whether regurgitation from the duodenum into the stomach continues.

Syphilis of the stomach is by no means a common condition, although a good many cases probably have been overlooked in the past. Eusterman reported 40 cases in a series containing 6000 cases of ulcer and cancer. While there seems to be some difference of opinion as to the gastric findings in syphilis of the stomach, probably most cases in which there is as extensive involvement as in the case we have seen this morning have achylia. Cases in which there is a fairly circumscribed lesion may have a normal or diminished acidity. Hyperacidity rarely occurs.

From a roentgenologic standpoint, Carman finds as characteristic the following:

1. A filling defect of gastric outline, usually without a corresponding palpable mass.
2. Shrinkage of the gastric capacity.

3. Stiffness and lessened pliability of the stomach wall.
4. Absence of peristalsis in the involved area.
5. Pylorus gaping rather than constricted.
6. Six-hour residue less common than in other gastric lesions.
7. Hour-glass stomach; upper loculus expanded and bulbous, lower loculus tubular, owing to extensive irregular concentric contraction.
8. Patient usually under cancer age and not ill in proportion to the extent of the disease shown by the x-ray.

The characteristic x-ray findings are the result of definite luetic pathology. In the first place, a gumma may be present, producing a palpable tumor mass. This condition may be indistinguishable from carcinoma grossly, the diagnosis not being established without the aid of the microscope. Second, such gummata may break down and give rise to ulcers of the stomach. Ulcer of the stomach may be present with or without sufficient new tissue formation to produce a tumor mass. In the third place, as a result of gummatous growth or of contraction of localized or circumscribed fibrous areas, various deformities may be present. Perhaps the most frequent of these is the hour-glass deformity. It may usually be distinguished from the hour-glass of a peptic ulcer by the fact that the distal pouch has a normal or nearly normal wall, free from the deforming contractures characteristic of lues. Fourth, the most striking gastric lesion produced by syphilis is the generalized cirrhosis which produces a much thickened stomach wall, in which on section one may see coarse interwoven strands of fibrous tissue from which the process has received its name of *linitis plastica.* It is this type of lesion which causes greatly decreased stomach capacity and the greatly thickened stomach wall which has given the lesion its other name—leather-bottle stomach. This is the lesion which was predicted in this case, and which we have found. Of course, not all stomachs to which this name is applied are syphilitic. A slowly growing scirrhous carcinoma may cause almost identical gross changes and require careful microscopic examination for nests or strands of cancer cells. Lastly, syphilis may give rise to a chronic gastritis of low grade. This is a pathologic rather than a clinical entity.

The prognosis is good in most cases of syphilis of the stomach if energetic treatment be instituted, provided the deformity of the resulting scar does not produce symptoms. Sometimes a chronic gastritis ensues which invalids the patient for a long time.

Postoperative Note (Dr. L. C. Gatewood).—The patient has been on active antiluetic treatment for about four months, with arsphenamin, mercury, and iodid. His general health has very markedly improved. Recently he has been able to take 1 quart of milk at a time without regurgitation or vomiting. (Compare this with 6 ounces capacity before operation.) He has gained weight and is working every day.

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CLINIC OF DRS. E. WYLLYS AND EDMUND ANDREWS

St. Luke's Hospital

TWO CASES OF LAMINECTOMY IN THE LUMBAR REGION FOR TRAUMATIC PARAPLEGIA

(Discussion of the Diagnostic Points by Dr. Charles Louis Mix)

CASE I

Summary: Patient with paraplegia resulting from an apparently slight injury to the spine. Presentation of history and diagnosis by Dr. Mix. Operation by Dr. Andrews. Result.

Mr. D.: This is a case of paraplegia following an apparently slight injury of the spine producing definite symptoms referring to the conus and cauda equina. Dr. Mix will present the history and analysis of this patient who has been under his care for considerable time.

Dr. Charles Louis Mix: The patient is a young man twenty-four years of age, who says that while riding in a Pullman car in August, 1920 he attempted, as young men frequently do, to muscle himself up between two seats; that is, he placed one hand on the back of one seat and the other on the back of the seat across the aisle, and then attempted to raise his body between the two seats. In doing this his arms gave way and he fell to the floor, a distance of about 4 feet. He struck upon his back. He immediately got up and laughed away the pain which the accident caused him, saying that he felt all right and that he was not hurt. Nevertheless, he admits that he was hurt rather severely and that the pain was very great. From this time on he had pain in the back, and early in September weakness began to develop in his left leg. The first thing that he noticed was a dragging of the toe, inability to extend the foot, a condition similar to that of toe-drop. Gradually the weakness extended, until in the autumn the right leg also started to show signs of weakness. Meanwhile the pain had continued in the back over the coccyx and over the sacrum, over the lumbar spine and over the pubic region, and down both legs. Associated with this pain he began to have sensory disturbances in the way of tingling and numbness, until ultimately sensation was in part lost.

During the autumn he was treated by a "practitioner" of some sort, who thought that the spine ought to be stretched. In the month of December he fell into the hands of a napropath, who thought that the back ought to be forcibly flexed and extended. During the last one of the treatments given him by this napropath he was suddenly seized with severe pains in the back. His legs became immediately worse, so that he was completely paraplegic and could not walk; and, worst of all, he was unable to relax the sphincter of the bladder. His inability to urinate lasted about three days, after which control gradually returned. After the accident resulting from treatment by the napropath it seemed evident to the family that a man conversant with neurologic work should be invited in to make a diagnosis.

I examined the patient on January 14th. The findings were as follows: Both knee-jerks and both ankle-jerks were absent. There was, of course, no ankle-clonus and the Babinski reflex was absent on both sides. On the other hand, the superficial abdominal reflexes were present and strong, and both cremasteric reflexes were present.

On testing out sensation, it was found that the area of hyperesthesia extended as high as the level of supply by the second lumbar segment of the cord. For example, the middle cutaneous branches of the anterior crural were anesthetic and the patient could not feel in the territory supplied by the external cutaneous nerve. On the other hand, he felt very well in the territory supplied by the iliohypogastric nerves, which come from the first lumbar segment of the cord. The protopathic sensibility was pretty much present all over both legs, but the epicritic sense was lost as high as the level of the second lumbar segment.

The motor losses correspond in distribution to the sensory, though they are more pronounced on the left side. For example, the quadriceps extensor was very paretic on both sides, and so also were his hamstring muscles, the muscles of the calf, the anterior tibial, and perineal groups. The extensors of the toes were more paretic than the flexors, and the grouping of the paretic muscles showed a disturbance practically coextensive with the disturbance on the part of the sensory nerves. There were no trophic disturbances in the way of ulcerations, but there was considerable loss of muscle mass in both legs, especially in the left, the measurement of which averaged from 1 to 1¼ inches less than those of the right leg. Bladder control was present January 14th, but imperfectly. It was very difficult for the patient to start the stream or to control the stream when started.

Discussion.—The symptoms which are present are those of a lesion of the cauda equina. The loss of the knee-jerks and ankle-jerks, together with the absence of spasticity and the presence of flaccid paralyses and atrophy of the muscles, corresponds to the peripheral type of nerve disease. This indicates an involvement of the nerve root rather than an involvement of the spinal cord. The absence of the Babinski reflex indicates that wherever the lesion was, it was at least beneath the conus, because in combined cauda and conus lesions we usually have a Babinski reflex present with absent knee- and ankle-jerks. Inasmuch as the territory was involved as high up as the supply of the motor centers of the second lumbar segment, it was evident that the lesion must be located where the fibers of the second lumbar segment issue from the spinal canal, namely, at the second lumbar vertebra. The sensory losses also aided very much in localization. There was the usual saddle-shaped anesthesia which is present in cauda equina lesions, but the sensory losses were much more than those found in ordinary lesions of the cauda, for they extended up as high as the supply of the middle cutaneous branches of the anterior crural. Moreover, there was sensory loss, especially of the epicritical sensibility in the territory of supply of the external cutaneous nerve. For this reason it was felt that the lesion must lie at a level sufficiently high for the fibers issuing from the second lumbar segment to be involved. This would mean that the cauda equina must be affected very close to the tip of the spinal cord which ends opposite the second lumbar vertebra.

The location of the lesion was a matter of much greater ease than the conclusion as to the pathology present. It might be thought that the accident alleged was one of the usual trivial accidents always described by a patient in the presence of grave lesions of the spinal cord. Indeed, the history of an accident is always forthcoming when any spinal cord lesion exists. The question that was uppermost was whether the lesion was a tumor or whether it was really due to a fracture-dislocation with compression and scar-tissue formation. There are certain facts which help to a conclusion. Tumors are usually associated primarily with pain, and after weeks or months motor losses occur. The history in this case was a primary history of pain occurring in August, without motor losses until some time in September. To be sure, the motor losses followed the sensory disturbances much too quickly for an ordinary case of tumor, but, on the other hand, the sensory disturbances were rather suggestive, as described by the patient, of root pains, which are commonly encountered in compressions by tumors. Spinal puncture was done for the purpose of arriving at more definite knowledge. It showed a normal cerebral spinal fluid. There was no increase in globulin or in the cell count and the Wassermann reaction was entirely negative.

An *x*-ray was then taken for the purpose of demonstrating any possible fracture of the vertebra in the lumbar area. Careful study of the plates failed to show any signs of splintering of the vertebra or of the posterior lamina. Nevertheless, the appearance of the second lumbar vertebra did not seem to be absolutely normal. There was too much shadow in the region of the left lamina, though there was no sharply demarcated outline found in this region. It seemed likely that there might be some scar-tissue formation opposite the second lumbar vertebra, with compression of the cauda. In view of the patient's critical condition—that he was paraplegic, that his bladder control was very imperfect, that the pain was very pronounced, and that there was considerable atrophy of the left leg—it was felt that the only proper treatment was a laminectomy. The location of the lesion was placed beneath the second lumbar vertebra, though it was conceded that there might be trouble beneath the third. The upper level of the epicritical disturbance, which is an extremely reliable localizing sign, occurred at the second lumbar segment of the cord or at the second lumbar nerve. This demanded the presence of a lesion, evidently as high as the second lumbar vertebra. Accordingly, operation was planned to expose the cauda from the second to the fourth lumbar vertebræ.

(Subsequent notes, April 26, 1921: The patient left the hospital for Louisiana on March 11th. He was at that time quite recovered as to his ability to walk, though he still complained of pain in his legs. A recent communication from the patient states that he is able to get about on his legs, that power in his legs is already well established, that his bladder control is perfect, and that his only complaint is still some pain at times in his left leg. While he was in the hospital his weight increased from 116¾ to 128¾ pounds on February 10th, the first day he was able to stand up to be weighed. At present he weighs 145 pounds.)

Operation by Dr. Andrews.—The history you have heard leaves no doubt of the necessity of immediate interference before paralysis and profound paraplegia have resulted. Just what pathology we shall find in the canal we are not able to state, as the *x*-ray showed only a slight thickening of the bone posteriorly, but it is probably of the nature of an osteitis and perhaps a dura cicatrix resulting from a periosteal trauma at the time of his fall. You will notice that our patient is in the prone position with the body slightly flexed backward, and the area from the middorsal to the sacral region exposed through our sheets and the skin prepared in the usual way. I make a median incision from the twelfth dorsal to the last lumbar spine, coming directly upon the bony prominences. The skin is then slightly retracted

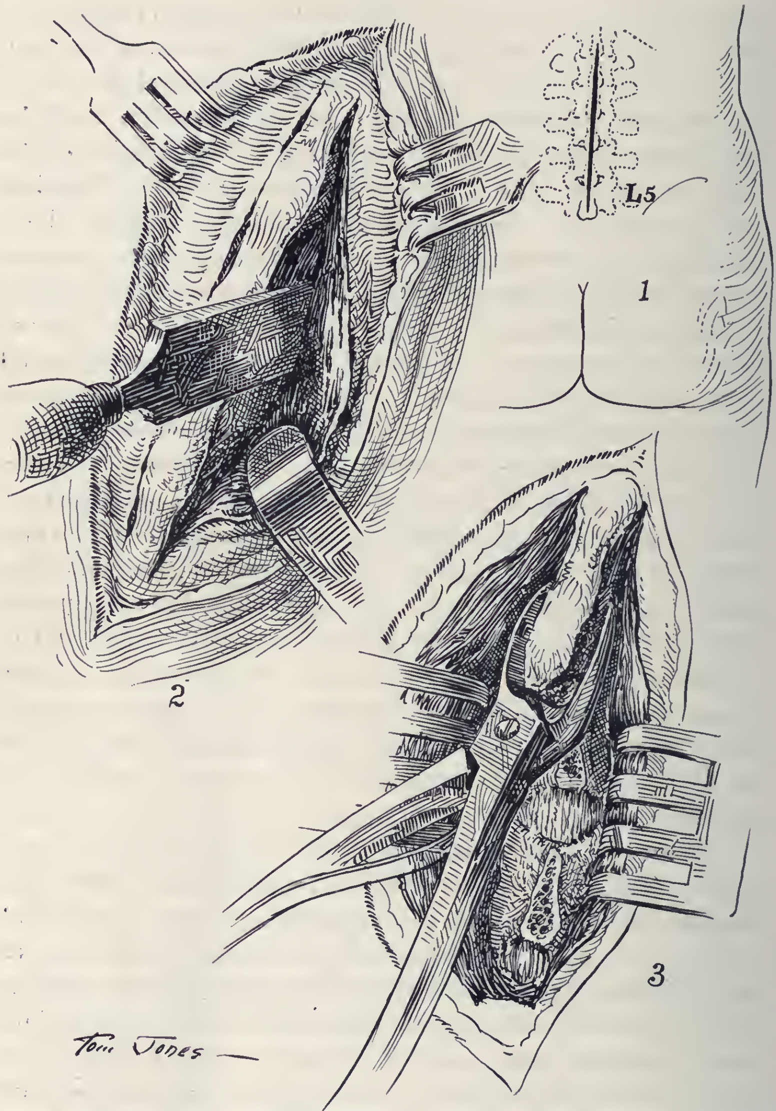

Fig. 486.—1, Incision. 2, Separating muscles from spines. 3, Cutting spines.

and the spinal ligament divided on each side, allowing the periosteotome to be used to separate the large muscles from the spinous processes. When this blunt dissection has been carried

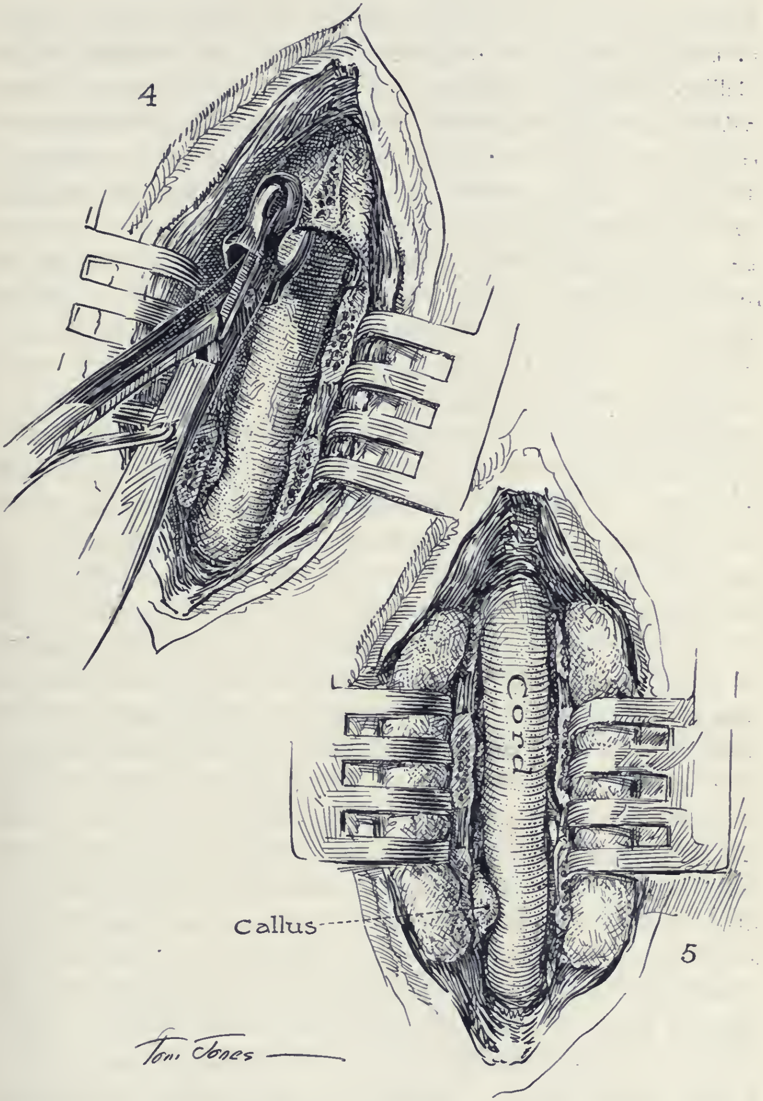

Fig. 487.—4, Dividing laminæ with rongeur. 5, Theca exposed, showing callus pressing on cord.

as far as the laminæ the Frazier retractor is inserted between these muscles and they are widely stretched apart. A similar instrument has been designed by Dr. Kanavel, of Chicago, and in the absence of these special retractors the ordinary Mayo-Collins abdominal retractor may be used. Spreading the blades with some force, we find that we can control the hemorrhage so that many small points do not require forceps or ligatures. The spinal processes and laminæ are now fully exposed and each spinous process is removed with a large cutting forceps over the area of the laminectomy, namely, the second, third, and fourth lumbar vertebræ. After cutting these spines away the laminæ are removed, and we wish to emphasize the great caution required in dividing these bony plates. You will notice we use a rongeur with very thin blades which bites away only ½ cm., and that we do not insert the DeVilbiss, or any of the large broad forceps, with one blade in the canal. In this manner we avoid any possibility of thrusting our instruments into the canal, which might damage the cord. It requires from one to four bites upon each side to divide the lamina completely, but the extra time is well spent, inasmuch as it avoids all danger of damage to the cord. This is not an imaginary danger, and we have seen cases in which at this stage the cord or theca was obviously injured, especially in the higher region of the canal. Having removed the three bony laminæ, the theca or dura is fully exposed. We now wish to call your attention to a step in the technic which we consider of importance and which we think we owe to the careful work of Frazier, of Philadelphia, namely, the use of dry cotton rolls or cigarettes placed over the wound beneath the retractor blade, which prevents weeping of blood or serum into the canal at the time of opening the theca. You will see that these white rolls have absorbed any slight blood oozing and keep the canal entirely dry. We now open the theca or dura with a very fine scissors like those used by the eye men, taking extreme care not to wound its contents. It is now obvious what is causing the pressure in this case. The spinal canal has been compressed mostly from behind by a thickening of the laminæ, especially that of the second lumbar vertebra, and by a thickening of about the same segments of the dura due to cicatricial deposits. The laminæ have exostoses present encroaching upon the lumen almost 50 per cent. of its diameter. I will with a flat, thin director explore upward and downward toward the dorsal and sacral segments of the canal. But I find no bony or other obstructions. It is, however, fair to conclude that we have by these alone—removal of the laminæ and opening of the theca—released the cauda and conus from a mechanical pressure. The wound will, therefore, be closed in tiers, catgut sutures approximating the muscle, and the skin being somewhat carefully and rapidly reunited by separate sutures. I place a silkworm-gut drain in the wound for a few days projecting from the upper angle of the wound.

Our experience in these laminectomies has been that with care wound infection is almost unknown and that the operative recovery is almost 100 per cent. In the cervical vertebræ our statistics show a larger mortality from the immediate shock of the operation and a smaller percentage of cure. It is also our experience, confirmed by the work of all modern neurologists, that there is no hope of regeneration of complete transverse lesions of the cord proper. Hence, laminectomy has been disappointing in the upper and middle sections of the spine. It may be that removal of the blood-clots, of fragments of bone pressing upon the dura, with or without laceration of its membrane, will often be followed by recovery. It is also a fact that some cases of paraplegia from injury, or even complete fracture, have recovered without operation. When we find in laminectomy above the cauda region, either from bullet wounds or from ordinary fractures with displacement, a complete severing of the cord we regard the operation as hopeless. In the lumbar region the exact opposite is true. We are dealing here with the branches of the peripheral nerves, and the same law applies as in nerve trunks generally, namely, if they can be brought in close approximation, regeneration can take place.

The after-history in this case verified our good prognosis. Almost immediately improvement appeared in bladder function. Within the first two weeks marked change in sensation and motor power was manifest, and in four or five weeks it was so advanced that the patient could get about. From that time (January, 1921) to the present the patient has been constantly gaining in strength. When last seen nearly all the signs of paraplegia had disappeared.

CASE II

Summary.—Severe injury of the spine following a fall in an elevator. Early treatment in this case: Use of the air-bed in the prevention of bed-sores. Operation. Result.

Mr. G. fell seven stories in an elevator and received almost fatal injuries. He was brought to the hospital in extreme surgical shock, almost pulseless, and unconscious. Under restoratives he regained his strength and was found to have a fracture and dislocation of one ankle, a comminuted fracture of the other, and multiple injuries of the lower spine, involving the body of the first lumbar and the lamina of the second, third, and fourth, as shown by physical examination and by *x*-ray. He was completely paraplegic in the area supplied by the first lumbar segment of the cord. Reflexes were not abolished, and it was thought then at the early stage that the injury might be more to the cauda and due possibly to compression without destruction to the conus. I will call your attention to the early treatment in this case, which consists in placing him upon an air-bed and supplying artificial heat and stimulants. You are all familiar with the extraordinary rapidity with which bed-sores develop in paraplegia, owing, as some think, to the trophic disturbances of the paralyzed parts, or, according to another theory, to anesthesia of the sacral tissue allowing ischemic pressure over that point which is without sensation. At any rate, it is a fact that such patients will develop enormous bed-sores in a few hours or days if lying upon a hard mattress, no matter how carefully they may be watched. An air-bed or a water-bed does away with this risk and should be the routine in such cases. It must be employed early in order to avoid this danger. Without anesthesia the fractures and dislocations were reduced, and an extension upon both legs while upon the air-bed was employed to relieve the marked kyphosis of the deformed spine. The patient hung between life and death for a few weeks, the paralysis of the thighs, legs, feet, bladder, and rectum becoming less total, and after about ten weeks voluntary movement could be elicited of the knees, but not of the ankles, and the numbness, which was bilateral, included mostly the distribution of the external cutaneous, but not the ilio-inguinal. At this time it seemed wise no longer to delay laminectomy for the relief of the diseased canal, and this operation was performed under general anesthesia. Bony union apparently had taken place in the body of the first lumbar and in the lamina of the second, third, and fourth. The same technic was employed as in the first patient, and a far more extensive bony deformity was found at operation. The laminæ were greatly deformed and the lumbar spinal canal was reduced to the form of a flat ribbon not over 1 cm. in diameter, along which the cauda lay in a flattened condition. The deformity of the body of the first lumbar could be felt projecting upward into the canal, but no attempt was made to remove bone at that point, the unroofing of the canal by the removal of the laminæ being considered sufficient. The naked-eye appearances were those of a greatly thickened dura and a periosteal and osteous thickening of the laminæ, and not a total severence of either the theca, conus, or caudal nerves. So far as noticeable the spinal foramina were not blocked and were not included in the operative work. The muscles were closed in tiers with catgut sutures and the skin with separate sutures, a small drain being used in the upper angle.

Primary union occurred in this case and the patient was kept in the hospital until a few weeks ago, returning to his home for further treatment after removal of the stitches. Improvement set in after the sixth month and has been progressive since, but has not yet become, and probably will not be, complete. He is now able to walk only by the use of iron braces to support the knees and ankles. With such braces he can get about somewhat freely. Whether re-education, tendon transposition, or any orthopedic treatment can relieve him further we are not sure; but, as the cord itself was in this case traumatized, it is probable that the motor neurons can never be repaired and some permanent paraplegia must remain.

The most gratifying and positive result was the restoration of bladder function and control of the rectum. Sensory function is also nearly restored. Motor power is regained in a degree about 50 per cent. above his former condition.

EXTRAPERITONEAL DRAINAGE OF A CHOLECYSTECTOMY WOUND

Summary.—Patient giving history of recurrent attacks of pain in the right upper quadrant. Diagnosis: Cholelithiasis. Treatment preparatory to operation. Operation. After-history.

Mrs. N. S., aged fifty-four, entered the hospital April 12, 1921. Family history is negative. Menstrual history is negative. Climacteric ten years ago. She has had 3 children and has had no miscarriages. The labors were all normal. After the birth of her last child, when she was twenty-six years old, she had a severe sepsis. There is no history of typhoid. Three years ago she began to have attacks of severe abdominal pain in the right upper quadrant, with radiation to the right scapular region, accompanied by nausea, fever, and chills. These attacks have gradually become more severe and more frequent. About ten years ago she began to have a chronic dyspepsia between the attacks, with frequent and severe headaches. She has never been jaundiced or passed any dark urine or clay-colored stools. The present attack began April 4th. The same symptoms were present, but much more severe. She has vomited frequently, the pains are much worse, and she has had some diarrhea. She was seen by Dr. Mix on April 6th, and he diagnosed a cholelithiasis. She was sent to the hospital for operation.

Examination showed a rather obese woman with a temperature of 101° F., pulse 96, and respiration 24. There was a subicteric tint to the conjunctiva. She was apparently in acute pain. Examination was negative except for the abdomen. We find marked rigidity and tenderness over the gall-bladder region. The liver is enlarged and is about 5 cm. below the costal border. The gall-bladder is palpable, enlarged, and is outlined about the size of an orange. White count is 15,500; red count, 4,500,000; hemoglobin, 90 per cent. The urine shows a trace of albumin, a few hyaline and granular casts, but no bile. The stools have a normal color.

It is in just such a case as this that much of the mortality in gall-bladder work occurs. Operation in this stage of gall-bladder disease is a very dangerous thing. We have here the typical picture of stone in the gall-bladder accompanied by severe infection. Experience has taught surgeons that in such cases the only safe procedure is to wait until the sepsis is controlled, and that waiting entails but very little risk if the case is carefully watched. If we operate in this stage the danger of spreading the sepsis, especially through the large veins in the region, is very great, and the incidence of septic emboli is appalling. Therefore, absolute rest, with morphin by mouth, and careful observation of the white count and temperature are indicated.

On the third day there was only one degree of temperature and the pain had partially subsided, but the count was up to 19,000. In the morning her temperature went to 102.6° F. and all the symptoms were worse. On the following day it went to 103.2° F., with a count of 20,000. Following this flare-up the improvement was rapid and steady until today the count is 10,000, with temperature of 100° F., pains very slight. I do not feel that the present is the ideal time to operate, but I fear to wait any longer. We will, therefore, if the gall-bladder is very much adherent and difficult to remove, drain it and cure the sepsis, and do an ectomy later if necessary. It is in the ectomy that the mortality runs highest in septic patients, though ordinarily the two operations have no special difference in mortality, particularly in this type of ectomy.

When the gall-bladder is exposed by right rectus incision and the other viscera are packed off, we see that it is entirely free. It is covered by glistening peritoneum, which is slightly edematous and rather loosely attached. It contains one large stone as big as a small walnut and several smaller ones. The ducts are easily palpable and are normal, containing no stones. The cystic duct is very short and thick. I am now slitting the peritoneum the entire length of the gall-bladder. It is thick and loose and comes off entire, making it possible to shell out the gall-bladder without tearing the peritoneum at all. Having gone down to the cystic duct, I will stop my dissection, clamp,

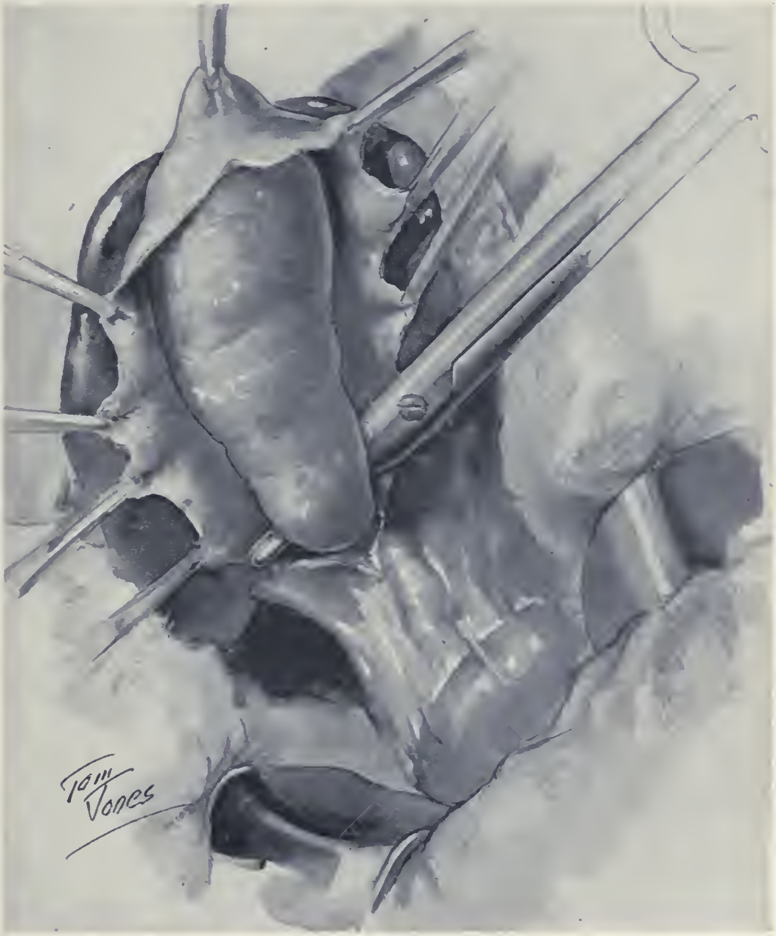

Fig. 488.—Gall-bladder partially shelled out, leaving serosa.

and ligate. In view of the special danger from sepsis in this case I will not open the retroperitoneal tissue and will leave the stump longer than usual. I believe that the danger of recurrence in those stumps is far less than that of dissecting and opening into the retroperitoneal lymph-spaces which would be necessary to remove the whole cystic duct close to the junction of the common duct. I will now lay a soft-rubber tube

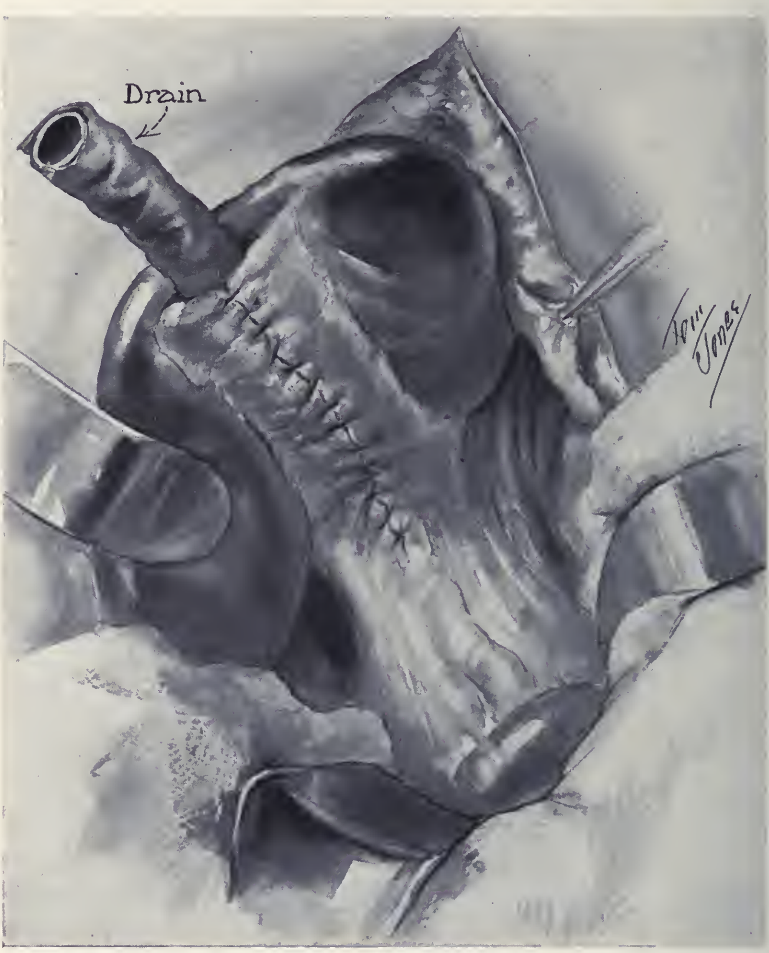

Fig. 489.—Drain in gall-bladder fossa. Peritoneum closed over it.

in the place where the gall-bladder was and suture the two flaps of peritoneum over it to cover it up. This drain will not be fastened with a ligature to the stump, as is my usual practice, but will be held in place by putting one of the sutures on the flap through it. What I have done now is to close the peritoneum. The drain lies in the gall-bladder fossa or between the liver and the peritoneum. The abdomen is closed in the usual way with a row of catgut sutures reinforced by a few silkworm sutures.

Discussion.—This procedure is, of course, the ideal way to deal with such a case. The drainage will not soil the peritoneum, which is well able to combat any infection spread at operation, and it needs no drain. The extraperitoneal spaces are amply drained, and even if bile should leak out past the ligature, it will not enter the peritoneum, and no jeopardizing mass of adhesions will be formed about my drain. Unfortunately, however, an operation of this type is rarely possible. Ordinarily we find the gall-bladder so scarred and adherent and the peritoneum so compromised that the making of such flaps would be an impossibility. However, it is always well to bear in mind, as, when possible, I believe it to be much the best procedure.

After-history.—The day after operation her temperature went to 101° F., the second day to 100° F., and after that there was no rise in temperature. The drainage was slight, being only serous in character, and there was no leakage of bile. The drain was removed on the seventh day and recovery was uneventful.

CLINIC OF DRS. EDWARD LOUIS AND LOUIS D. MOORHEAD

Mercy Hospital

WRY-NECK: TWO CASES—ONE CONGENITAL, THE OTHER ACQUIRED

Summary: Etiology of wry-neck—classification, diagnosis, and treatment. Presentation of two patients illustrating the congenital and acquired varieties.

We have two very interesting cases to present to you this morning. The first shows the end-result after operative treatment for congenital wry-neck. The second patient is suffering from the acquired form of the same condition, and as yet no means have been employed to correct the deformity.

Our first patient, Mr. L. J., is eighteen years of age, an American by birth, but of Polish descent. He entered the hospital ten weeks ago and gave us the following history:

As far back as he could remember his head had been held fixed in a position of flexion to the right and slightly downward. There had always been a very marked limitation of motion, so that patient was accustomed to turning the entire upper half of his body when he desired to view objects about him. At no time had he suffered pain or tenderness in the neck muscles. His general health had always been good. He had suffered from the usual diseases of childhood. Venereal history was denied and a routine blood Wassermann was negative. His family history was negative and his habits seemed to be without influence upon his present condition. The general physical examination was negative except for the following points: The head was held in a fixed position, flexed to the right and slightly downward. The right sternocleidomastoid muscle was much shorter than the left. The muscle stood out prominently in its entire course and the clavicular and sternal attachments were very clear. There was a definite bowing upward of the right clavicle, the highest area of the convexity corresponding to the attachment of the sternocleidomastoid muscle. A compensating curvature of the cervical vertebræ was noted.

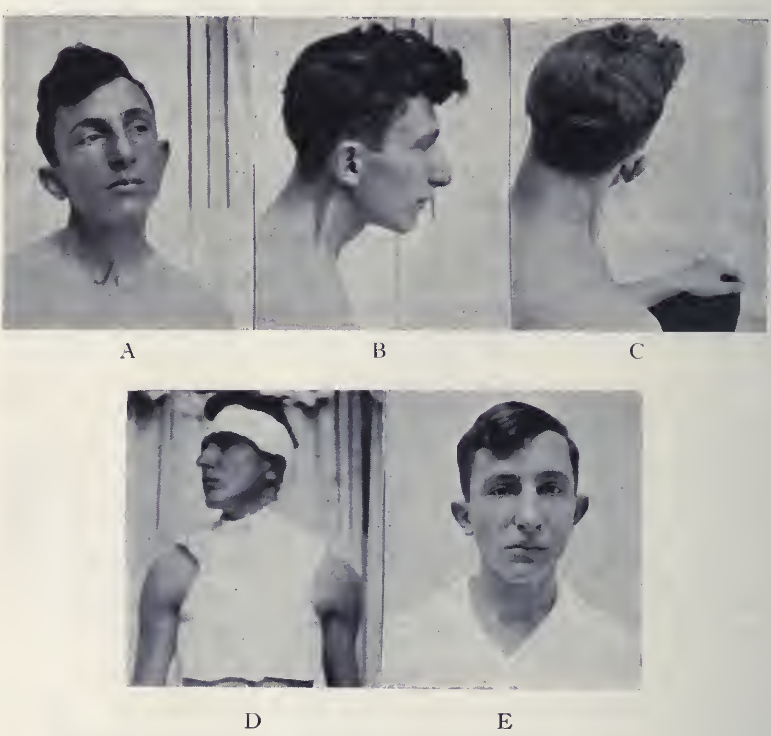

Fig. 490.—Case I. Congenital wry-neck (chronic form):
A, Front view
B, Lateral view } before operation.
C, Posterior view

Postoperative view: D, Cast applied. Head in overcorrected position. E, End-result of operations. Position normal. Flexion, extension, and rotation perfect.

Our second patient, Mrs. B., is forty-three years of age, an American by birth; she gives us this very interesting story: A little over one year ago she began to have a sharp pain in the right side of the neck. The pain came on suddenly and was accentuated if she attempted to rotate her head. A feeling of stiffness was experienced in the muscles on the right side of the neck, and in a few days the patient noted that her head was flexing to the right and slightly downward. As she describes it, the great cord on the right side of her neck was growing shorter and thicker. The pain and tenderness persisted. For a little time previous to the onset of the condition the patient recalls that she experienced trouble with the lower teeth on the right side, in fact, one tooth was ulcerated. During the past year the condition of the neck has remained about the same, with the exception that pain did not remain constant, but has had acute exacerbations.

She has consulted various physicians for relief from her condition. One of the early procedures was the removal of the patient's teeth and the subsequent treatment of the gums in an endeavor to eradicate a possible focus of infection. At a later date another physician performed a tonsillectomy, working most probably along the same basis. So far no form of treatment has furnished any relief from the acquired deformity.

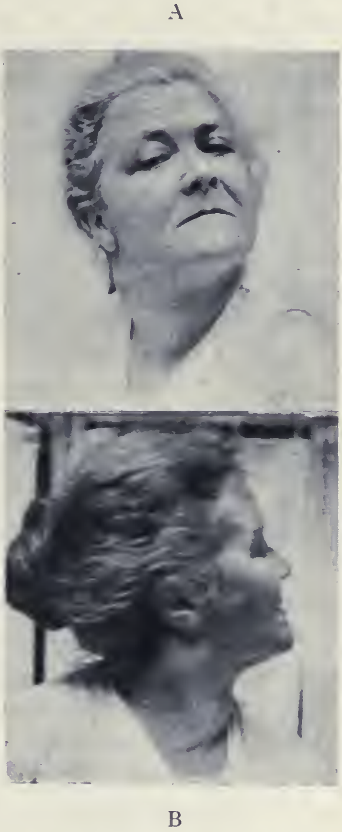

Fig. 491.—Case II. Acquired wry-neck (acute form): A, Anterior view. B, Lateral view.

General physical examination is negative except for the following notations: The head is held fixed in a position flexed to the right and slightly downward. The right sternocleidomastoid muscle is contracted and prominent during its entire course. There is evidence of pain upon any attempt at rotation of the head. There is tenderness, particularly along the upper portion of the right sternomastoid muscle. The upper portion of the right trapezius muscle is contracted, but not tender. A view of the mouth and pharynx shows that the teeth have been removed and the gums are in good condition. The tonsils also have been removed. There is some cervical adenopathy, possibly a little greater on the right side.

Wry-neck or torticollis is, as the name implies, a twisted neck, a distortion caused in most instances by active contraction or by shortening of one or more of the lateral muscles that control the head. Similar distortion may be due to disease of the spine, so-called false torticollis, but this should be classed as a symptom of the underlying disease, not as simple torticollis, of which the distortion itself is the important disability that demands treatment.

Torticollis may be divided primarily into two classes: the congenital and the acquired. These patients are representatives of the two types. Congenital torticollis is a painless shortening of the tissues on one side of the neck of intra-uterine origin. Acquired torticollis is, in most instances, accompanied in its early stages by local pain and sensitiveness, and by active contraction of the affected muscles. After a time these acute symptoms usually disappear, leaving simply the deformity. Thus, from the therapeutic standpoint, torticollis may be classified as acute and chronic, the latter cases including the congenital form.

The sternocleidomastoid is the muscle that is usually involved primarily, both in the congenital and acquired forms; hence, in typical torticollis the head is drawn somewhat forward and is inclined toward the contracted muscle, while the neck is pushed, as it were, away from the contraction; the chin is slightly elevated, and turned toward the opposite shoulder—an attitude explained by the normal action of the affected muscle. Irregular distortions of the head—as posterior or anterior torticollis due to contraction of muscles other than the sternomastoid—are, however, not infrequent, especially in the acquired forms.

Torticollis is considered one of the less common deformities, and the acquired is by far the more frequent form. Statistics indicate that the occurrence is somewhat more common in females than in males, and that the left side is affected more often than the right.

In most instances the deformity of congenital torticollis is slight at birth, and it may not attract attention until the child supports the head or even walks. Frequently, as in the case of this boy, the patient is not brought for treatment until the distortion has persisted for some years; as a consequence of this it is often difficult to distinguish the congenital form from the deformity that may have been acquired in infancy.

Slight torticollis may be demonstrated even in early infancy, and you accomplish this by fixing the shoulder on the affected side and drawing the head forcibly in the opposite direction, when the shortened muscle becomes prominent beneath the skin, evidently restricting the range of motion. The sternal division of the muscle appears, in most instances, to be more shortened than the clavicular portion.

It is rare to see a case in which the deformity in infancy is extreme. When it does occur, it is usually accompanied by well-marked asymmetry of the face and even by distortion of the skull. In this class the shortening may involve all the lateral tissues, both anterior and posterior, and is often complicated by malformation of the cervical vertebræ. If asymmetry is present at birth it increases somewhat with growth. Even in the acquired form it often appears soon after the onset of the deformity, becoming more marked with its continuance.

Its cause is explained by most authors by the constrained attitude, the restriction of normal use, and consequently of blood-supply, combined with the tension upon the tissues of the face, as is evidenced by the fact that it becomes less noticeable after the deformity has been corrected.

In well-marked cases of long standing, whether congenital or acquired, we sometimes note that the face on the affected side is shorter and flatter, the nose and the corner of the mouth and eyelids are drawn downward, and the skull shows evidence of atrophy and deformity.

As are evidenced in the case of this boy, secondary distortions also appear in the trunk in chronic cases. These are rotation of the spine to compensate for the lateral distortion of the head and an increase in the dorsal kyphosis, "round shoulders," as we commonly call it. Upward bowing of the clavicle caused by tension of the contracted muscle is noted also.

The lateral distortion of the head is lessened in cases of long standing, the compensatory convexity of the cervical spine displaces the head and neck toward the opposite shoulder.

We wish to call your attention to the fact that the compensatory deformities are slight in infancy, but they develop in later childhood, for in many instances the growth of the affected muscle is checked; thus, an original shortening of ½ inch, as compared to its fellow, may be increased to 2 or more inches in later years. This fact emphasizes the importance of treatment as soon as may be possible after the distortion is discovered. As has been stated, the important contraction is usually of the sternomastoid muscle, but if the deformity is uncorrected all the lateral tissues become shortened.

Typical wry-neck caused by shortening of the sternomastoid muscles is by far the commonest form of congenital torticollis, but occasionally cases are seen in which the head is but slightly inclined to one side and in which the shortening appears to involve the lateral tissues in general rather than a particular muscle.

It may be assumed, disregarding the possible influence of hereditary predisposition, that congenital torticollis is, in most instances, caused by a constrained or fixed position in the uterus for a longer or shorter time before birth. It is, in fact, a simple distortion, and that it has in the majority of cases no deeper significance is proved by the fact that it may be easily and completely cured by simple division or elongation of the contracted tissues. We do not believe that the theory of Stromeyer as to the etiology of congenital torticollis is probable.

According to this theory the condition is caused by rupture of the muscle, probably at the time of delivery, and by myositis about the resultant hematoma which may involve and ultimately destroy a large part of the substance of the muscle, replacing it with fibrous tissue, which contracting, causes deformity.

Acquired torticollis is an affection usually of early life. It is unusual for the condition to occur in a person as old as our patient. While congenital torticollis is usually a painless shortening of the muscles, acquired torticollis is, as a rule, a painful affection secondary to injury or disease of some of the structures of the neck, which causes irritation of the peripheral nerves and active contraction of the neighboring muscles. Thus, as a rule, the number of muscles involved in the deformity is greater than in the congenital form; for example, in this woman we see that both the trapezium and sternomastoid are contracted. Irregular forms of distortion caused by spasm of other muscular groups are not uncommon.

For our own convenience let us consider the varieties into which acquired torticollis may be classified. They are:

1. The simple or mechanical form, due to scar contraction following destruction of the skin or deeper tissues, as from burns or disease.

2. Acute torticollis caused by direct irritation of the muscle, by injury, by inflammatory affections of the surrounding parts, combined in most instances with irritation of the peripheral nerves, which causes reflex contraction of certain muscles or muscular groups.

3. Spasmodic torticollis, a form of convulsive spasm defined by Walton as "a disorder of the cortical centers for rotation of the head."

4. Irregular forms of torticollis—paralytic, ocular, psychic, and the like.

Our second patient this morning fits into the second group of this classification.

One must be sure and consider the acute form of Pott's disease before he makes a positive diagnosis of acute torticollis. In the latter condition the affection is of sudden onset and is not preceded by the stiffness and neuralgic pain that characterize tuberculous disease. The deformity of torticollis is almost always of the regular type. The spasm and contraction of the affected muscles are apparent, and direct tension upon them is painful. If, however, the tension is relaxed by inclining the head toward the contraction, movement of the head in other directions will be found to be practically unrestricted.

Congenital torticollis, if of moderate degree, may be overcome in early infancy by methodical stretching of the contracted parts. One person fixes the arm and another draws the head gently but firmly in the direction opposed to the contraction, over and over again, meanwhile massaging the tissues of the neck. This procedure should be repeated several times a day; it causes slight momentary discomfort if properly performed, but this ceases when the stretching is discontinued. Care should be taken also that posture may, as far as possible, favor the reduction of the deformity; thus while the child is in its mother's arms the head should be supported, and when asleep the pillow may be arranged in a manner to prevent the improper position. In this way the torticollis may be entirely corrected or its progress may be checked until more effective treatment is indicated.

Subcutaneous tenotomy is an operative procedure that we believe should be mentioned only to be condemned.

The resulting condition in this boy you see is perfect. The treatment employed consists of two parts, each of equal importance. The first part is the operative procedure, and we did an open myotomy and faciotomy. This operation accomplishes all that is desired. In adults local anesthesia may be employed, but in this case ether was used. After suitable preparation, the incision was made transversely about a fingerbreadth above the clavicle. The muscle was divided transversely, and to protect deeper structures the division was made over a director inserted under the muscle. Both heads, the sternal and clavicular, were divided, for it is important to be able to overcorrect. When the muscles had been divided and the head had been tilted to the opposite side, one band of fascia after another sprang into prominence, and these were divided with the knife, working over the director. The wound was closed by a subcuticular catgut suture, without drainage. When the wound had been dressed the second important step in the treatment was the dressing, by which the maintenance of the head in the overcorrected position was accomplished.

A plaster-of-Paris splint was applied to hold the head in the overcorrected position. The chin was rotated to the right, since the right sternomastoid had been divided, and then the head was flexed toward the left shoulder. The plaster included the upper thorax and neck and ran upon the back of the neck and surrounded the head, that is, the body from the diaphragm up was enclosed except the arms and the face. The splint was kept on not only until the wound had firmly healed, but until the soreness had disappeared in the operation region—five weeks in this patient. During that time the splint was changed twice, so that it was at all times sufficiently rigid to maintain the overcorrection. After its removal active and passive movements were begun, and these are being continued.

At the present time you will notice that the boy is able to rotate and flex the head with ease. The result of this case is ideal. To the casual observer his former condition would not be suspected.

What of the treatment for our second patient? Viewing this patient today we may say that the treatment of her condition can be divided into three parts: First, during the acute stage hot applications and a firm wide thick collar of flexible cotton stiffened by several layers of adhesive plaster is an agreeable support, particularly if there is much pain; second, an endeavor to search out and eliminate the focus of infection. This step seemed to have received considerable attention in this patient. Third, correction of the resultant deformity that sometimes occurs, as we have it here. When this condition has become chronic, it may be sufficient to overcorrect it under anesthesia and then maintain the head in the overcorrected position by means of the plaster splint already described. This treatment may be employed in relatively early stages of selected cases. As a rule, when deformity has been allowed to persist for six months or more, its rectification will require division of the more resistant tissues.

CLINIC OF DRS. CARL BECK AND VERNE S. CABOT

NORTH CHICAGO HOSPITAL

LIPOMA ARBORESCENS OF ANKLE-JOINT

Summary: Lipoma arborescens of right ankle-joint occurring in a patient previously operated on for a spindle-cell sarcoma of the fascia lata of the same leg.

MRS. C., fifty-four years of age, has for the last five months noticed a swelling over the external malleolus of the right ankle. This swelling causes some pain in walking. Five years ago she was operated by us for spindle-cell sarcoma of the fascia lata extending over the whole front of her right limb. There has been no recurrence of the sarcoma since that time, but the patient is afraid that this growth over the ankle may have some connection with it.

Examining the swelling over the ankle we find that it has the consistency of a lipoma, is lobular, and easily felt through the skin. It is, however, not freely movable, and seems to be connected with the joint in some way, because on extreme flexion of the joint it becomes somewhat larger, as though a portion of it had been pressed out from the joint. Otherwise it seems to be closely connected with the capsule. Since it is interfering with her walking and causes her considerable annoyance, we have decided to remove it.

Operation.—An incision is made in the long axis of the limb. Upon reaching the capsule we find that the tumor consists of a fatty lobulated substance exactly like the ordinary lipoma, and that it has a small pedicle which connects it with a similar structure inside of the capsule (Fig. 492). After dilating the small perforation of the capsule we are able to extract from the inside of the joint cavity a mass about one-third the size of the external tumor. We close this small breach in the capsule and unite the skin.

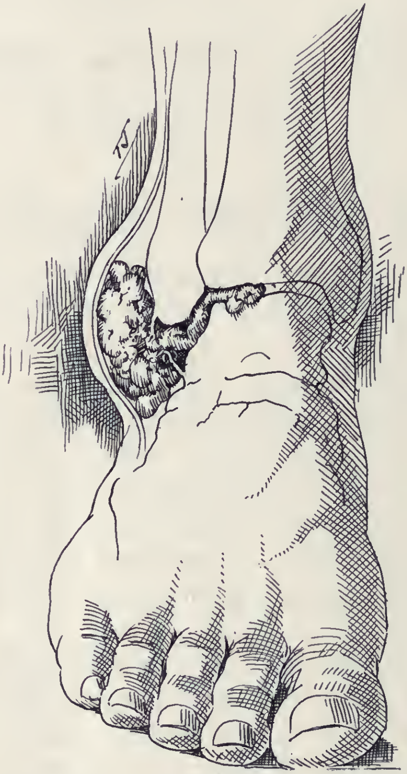

Fig. 492.—Drawing showing lipoma on the outside and inside of the capsule. The capsule is penetrated by the pedicle into the center.

The diagnosis is a lipoma arborescens, a pathologic condition which occurs quite frequently in the knee-joint, but is rather rare in the locality of the ankle-joint.

The patient made an uneventful recovery and was able to walk without pain a week later.

PARTIAL NECROSIS OF COCCYX DUE TO INJURY TWO YEARS PRIOR TO OPERATION

Mr. H. E., banker, forty-five years of age, comes complaining of tenderness over upper intergluteal fissure in region of coccyx. He states that the pain and tenderness have been present for the past two years, and that both would disappear at times for a period of from several weeks to a month, only to reappear and last for several months.

On questioning, the patient gave the history of a severe fall on buttocks in the winter of 1918, with no apparent immediate after-effects. During the past six months, however, he has noticed one especially tender spot over upper coccygeal region. This is markedly painful upon riding in a sitting posture, especially in an automobile.

During the past two years he has had treatment for hemorrhoids and fissures as the probable cause of his trouble, but with no lasting benefit.

Family History.—Father died of sarcoma of coccyx. The previous history is negative except for the fall on buttocks two years ago. Physical examination, on deep palpation, shows a definite mass about the size of an orange over posterior rectal wall. Proctoscopic examination reveals several small internal hemorrhoidal areas with a small fissure. No apparent connection between rectal and perineal condition could be established. During stay in the hospital prior to operation he occasionally had a temperature of 99.4° F., but not sustained, and without chills or sweats.

Urine examination is negative. Blood count shows 11,700 leukocytes, with a normal differential count. Wassermann reaction is negative. Blood-pressure is 140 systolic and 85 diastolic.

Roentgenographic examination shows an irregular outline of the coccyx, with a suggestion of partial absorption of remaining portion.

Four days after admission, under general anesthesia, a curved incision over coccyx was made and 300 c.c. of thick, creamy pus removed from a multilocular cavity. Pus contained several small particles which proved to be necrosing sequestra from coccyx. Remaining portion of coccyx was removed at this time. Abscess cavities were cleansed and packed. The wound was closed in part by one deep silkworm-gut suture. The cavity closed rapidly by granulation and a secondary closure was made on the eighth day.

This case is of interest in that the primary cause of the trouble in all probability dated back two years, with the intermittent periods of quiescence of his symptoms, and on account of the history of sarcoma in his parent. The pathologic report was negative for sarcoma.

BILIARY FISTULA AND CHOLECYSTECTOMY

Mr. M. B., insurance broker, aged fifty-eight, comes for relief of a discharging fistula located in a linear scar in upper right abdominal quadrant.

The family history is negative. Previous history, six years ago, following a period of several years of gastric disturbance with attacks of colic in upper right abdominal quadrant, a diagnosis was made of cholelithiasis. He submitted to a cholelithotomy, at which time many small stones were found. He tells us that the wound drained for ten days and that his recovery was uneventful. He remained free from symptoms for the next two years, when he began to again experience his previous chain of symptoms—right costal margin pain, colicky in type, with occasional chills, belching, nausea, and epigastric distress, but no jaundice. He was treated medically until three years ago, when he again submitted to a drainage of his gall-bladder. At this time three stones, each the size of a hazelnut, were removed. The drains were left in for twenty-two days at this second operation.

He states that the second operation was attended with profuse hemorrhage which prevented the intended removal of the gall-bladder. At this operation, following the removal of drainage-tube from the gall-bladder, a small fistula remained. This at first discharged bile-colored fluid, gradually discharging less in amount during the first four months. From then to date it has remained unchanged. He says the discharge became less bile colored and more mucoid in consistency. This condition persisted for the past three years, and he is now seeking relief primarily for a cure of this fistula.

Upon further questioning he says that following the second operation he remained comparatively free from his previous complaints until six months ago. During this time he has had several definite attacks of colic without jaundice, and also occasional periods of nausea, belching, and anorexia. He does not vomit, but says he feels his best when stomach is comparatively empty, and that heavy sweets or fatty foods increase his distress. There is no history of hematemesis, melena, or clay-colored stools.

General examination was negative except for the presence of a fistula discharging on the skin surface in upper right abdominal quadrant. The discharge was mucoid in character, small in amount, yet necessitating a daily dressing. Roentgenographic examination of the gall-bladder region revealed no visible calculi.

Operation.—Under ether anesthesia a Bevan incision was made from ensiform to level of umbilicus, passing to left of fistulous opening. The incision was then carried around the fistulous tract and the tract closed by suture and bound with gauze.

In view of two previous abdominal sections in this region many adhesions were anticipated. However, the gall-bladder and adjacent tissues were remarkably free from adhesions. The gall-bladder was small, with thick, non-elastic walls, somewhat tense. The fistulous tract drained from near the fundus. On palpation a stone was found wedged in the distal portion of the cystic duct. It could not be dislodged by manipulation. Examination of remaining portions of biliary tract was negative for calculi or apparent pathologic conditions.

Using the fistulous tract as a tractor, the gall-bladder was then freed from its liver bed from above downward, and removed, including that portion of the cystic duct containing the calculus. The wound was then closed, leaving a cigarette drain extending down to the stump of the cystic duct, and also a gauze drain extending to the surface from the pouch of Morrison.

Convalescence was uncomplicated. The drains were removed on the fourth day and he returned home at the end of the sixteenth day.

The interesting features of this case are the presence of a calculus, and the remarkable freedom of gall-bladder and adjacent tissues from adhesions in view of two previous sections.

PLASTIC OPERATION FOR TREATMENT OF LARGE EMPYEMA CAVITY

Mr. W. B., an aviator, twenty-nine years of age, presented himself for relief of fistula in right lower chest following drainage of an empyema.

Previous History.—He had the usual diseases of childhood, and enjoyed good health until 1913, when he had a pleurisy with effusion on the right side, which subsided without tapping, with no apparent after-effects. In 1917 he had a right-sided mastoiditis, for which a simple mastoidectomy was performed. In 1918 he had a partial turbinectomy and septum repair. His family history was negative.

The history of his present ailment dates back to December, 1919, when he had influenza, following which he developed a right-sided lobar pneumonia, with the crisis on the ninth day. He also had a pleural effusion, and upon his first tapping a diagnosis of empyema was made. He was tapped twice in the following week. He was then subjected to an intercostal drainage in the seventh interspace in the axillary line. Dakin's solution was used four times daily to irrigate the cavity. Everything was progressing nicely when, unfortunately, the drainage-tube slipped into the pleural cavity, and after much manipulation an operation under general anesthesia had to be resorted to in order to get out the tube. It was necessary to resect the seventh rib to do this.

Tube drainage was continued and he drained steadily until he left the hospital in April, 1920. In May the tube was removed, the wound closed, and the patient gained in weight. He left for the Pacific Coast in June. He pursued his work until the latter part of August of the same year, when he again began to lose in weight. Loss of appetite, elevation of temperature, productive expectoration, and the signs of another accumulation of pus were apparent. Numerous examinations of sputum were negative for tuberculosis.

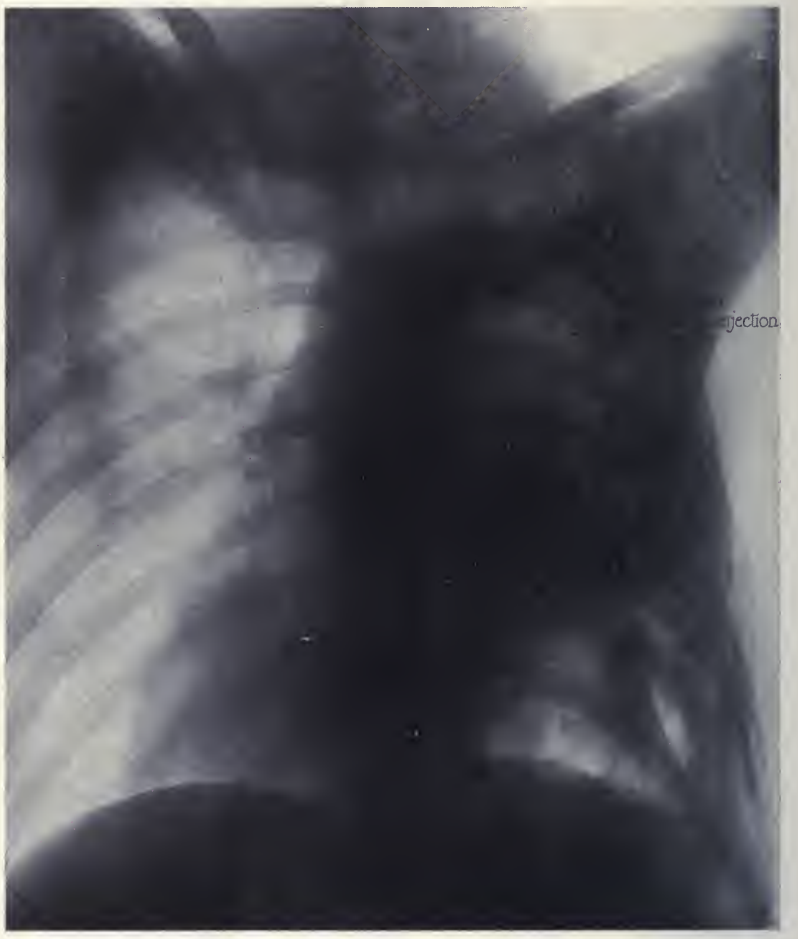

Fig. 493.—Roentgenogram showing empyema cavity before injection with bismuth.

Another accumulation of pus being diagnosed, a costal resection with adequate drainage was deemed necessary, but refused, so intercostal drainage was again resorted to, drainage being introduced through the old wound. It was maintained for the next three weeks, with irrigation every two hours with Dakin's solution, and the wound again allowed to close. He gained 10 pounds in weight and resumed his work in November, only to have a similar recurrence again in December, 1920, when we first saw him.

Physical Examination.—The chest examination showed a retracted lung, apparently with no adhesion at the apex, but the basal portion seemed adherent to the diaphragm (Fig. 493). The fact that some of the fluid of the Dakin's solution escaped through the larynx, and the fact that even if this did not happen, he could taste these injections, made it certain that he had a bronchial fistula, although a very small one. Bismuth injection (Fig. 494) revealed the same condition as the clinical examination, namely, an old incurable, large cavity with retracted lung which spontaneously, or with ordinary treatment, would not close.

The catheter which was daily introduced to the extent of 6 to 8 inches drained only a limited quantity of pus. As it was introduced it passed into a narrow channel which grasped it tightly, and did not permit any pus to pass along it. When the catheter was removed, however, a gush of pus indicated that there was a pus-pocket which was not emptied by means of the catheter.

During the daily dressing the nurse found only the external portion of the catheter in the dressings, about 7 inches of it having been sucked into the cavity by a coughing spell (Fig. 495). With the aid of a urethral endoscope we located the red rubber tube and extracted it without operation; but this accident hastened our determination to undertake radical treatment, namely, to resect a large portion of the front and side of the thorax, and to implant the skin-flap as a lining of the chest cavity.

Operation.—Under general anesthesia we incised the chest wall and resected the fourth, fifth, sixth, and seventh ribs to the extent of about 3 inches in width. We incised the very thick pleura and found the lung retracted toward the hilus, the apex perfectly free and hollow to the extent of a fist (Fig. 496).

We made a tongue-shaped flap with a base toward the axilla, and turned it with its point to the hollow of the apex cavity, and packed several pieces of gauze into the cavity to keep the flap in place (Fig. 497).

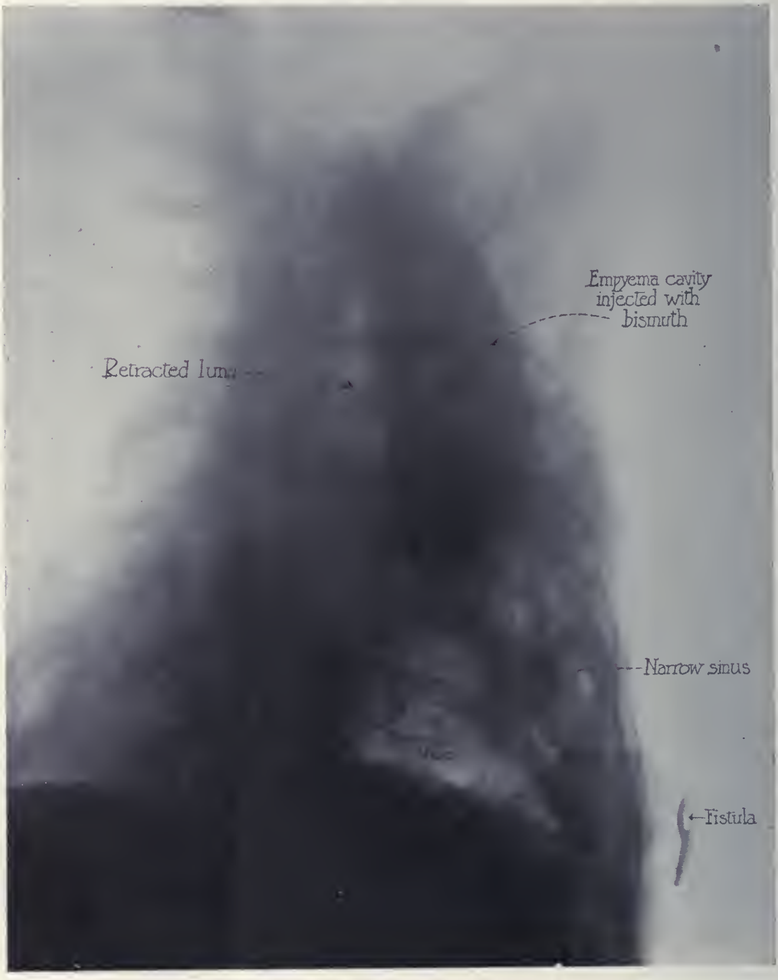

Fig. 494.—Roentgenogram showing empyema cavity after injection with bismuth.

Subsequent note: For the first time in a few weeks the patient is free from fever. The flap heals perfectly in position, the cavity gradually discharges less pus, and the quality of pus becomes more serous. On the eighth day the patient is up and around and from now on the cavity will gradually heal with

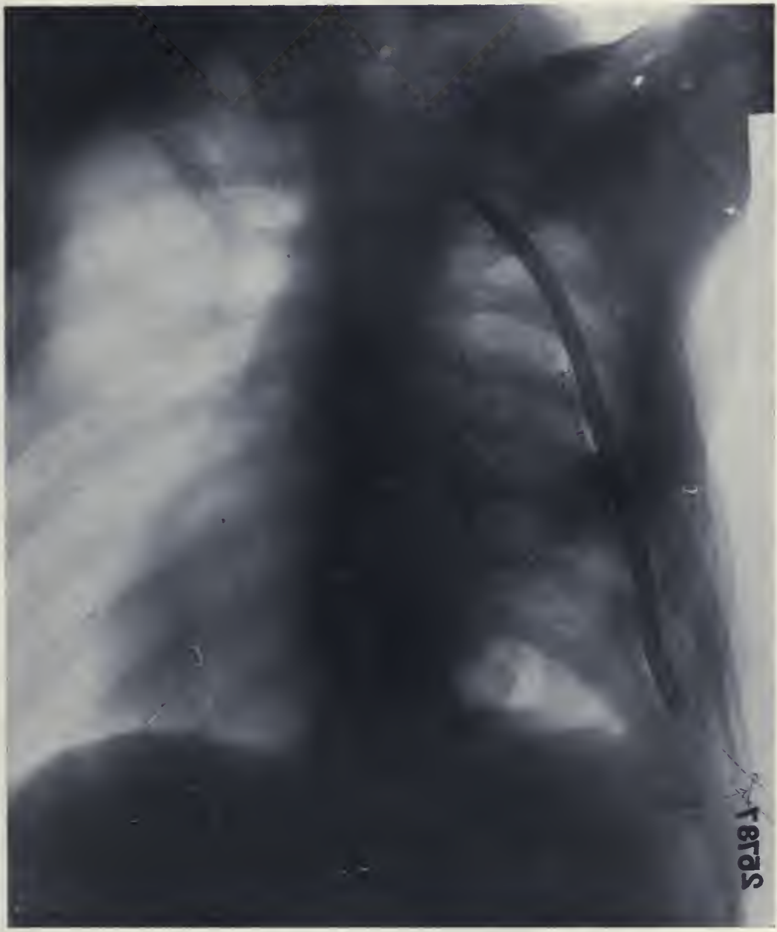

Fig. 495.—Roentgenogram showing catheter in position and point at which catheter was sucked into cavity by a coughing spell.

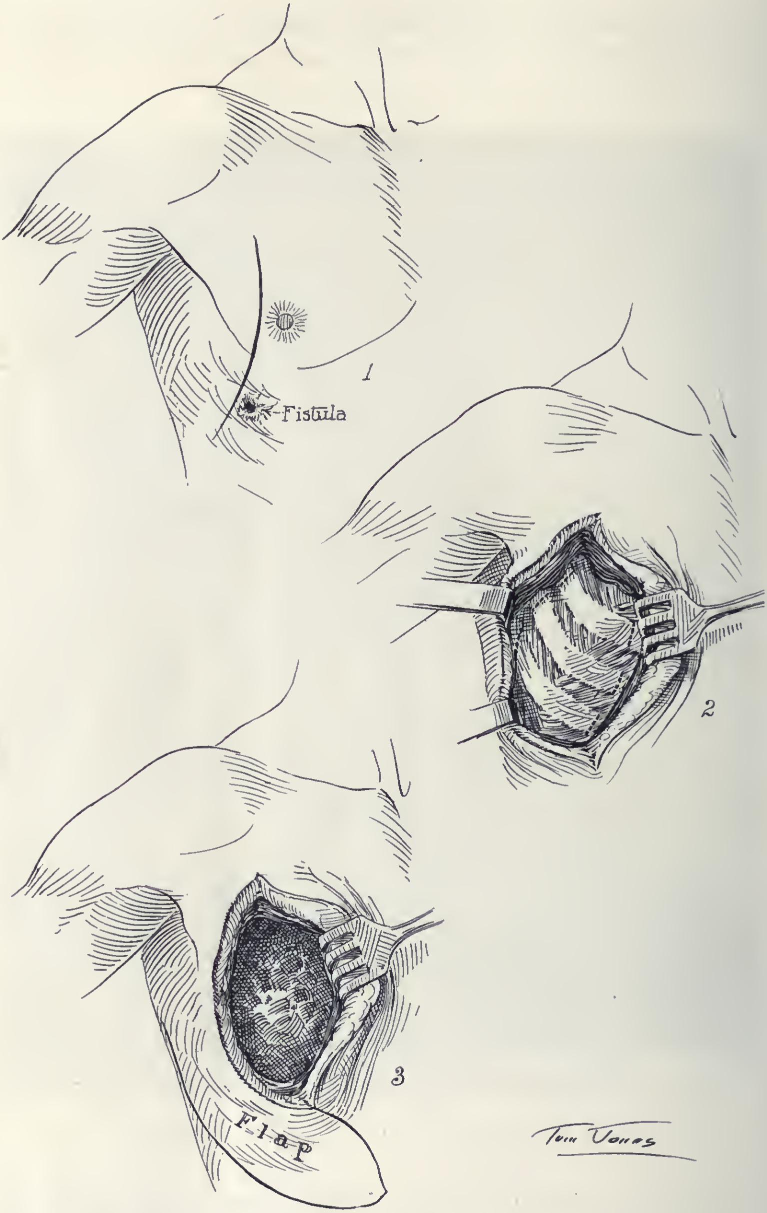

Fig. 496.—1, Appearance of chest before operation. Line of incision. 2, Ribs exposed, ready for resection. 3, The ribs removed. The thickened pleura anteriorly removed for a considerable extent, exposing large cavity. Outline of flap.

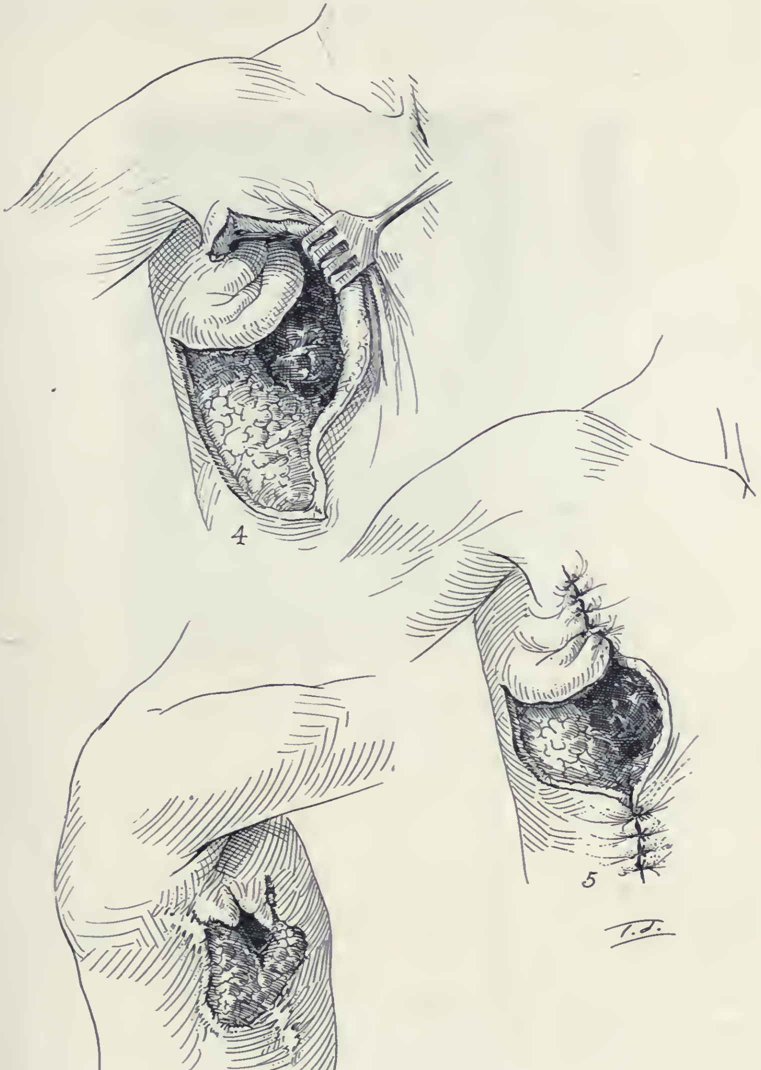

Fig. 497.—4, The flap inverted into the cavity is kept in position by packing gauze into cavity. 5, Suture of the wound borders which can be approximated, showing lung in the lower part. 6, Drawing showing appearance of chest after one week.

scar and epidermis. There will be, as the picture (Fig. 498) shows, a deep recess in that side of the chest.

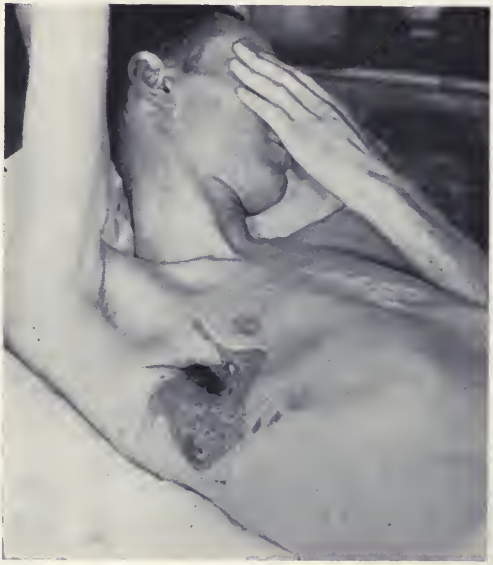

Fig. 498.—Photograph showing deep recess in that side of the chest.

POSTOPERATIVE APPENDICAL FECAL FISTULA

Mr. H. M., thirty-one years of age, and a candymaker by occupation, came complaining of a discharging fecal fistula in the right lower abdominal quadrant of three months' duration.

Previous History.—He said that he had always been well until the present trouble. He denied all venereal infection.

The present trouble dated back five months, when he was taken with an acute right lower abdominal pain, nausea, and vomiting. His physician advised immediate operation for an appendical infection, to which he finally submitted on the sixth day. At operation the preoperative diagnosis was substantiated, the appendix having ruptured, and a localized peritonitis was found to be present.

As his previous hospital history was not available, his narration of his case was accepted. He said drainage was instituted at time of operation, a glass tube being retained in the wound for three weeks, which was then replaced by a rubber tube drain for nine more days, at which time the tube could not be kept in place because of diminution of the caliber of the tract.

He told us that drainage was profuse for the first week and then subsided; but drainage was continued for three weeks more. He left the hospital at the end of the second month, but a fistulous tract remained in the lower angle of the wound which discharged fecal matter. His surgeon on two occasions attempted closure by freshening the fistulous borders and suturing, but without success. Three months later he presented himself for relief of a fecal fistula.

Examination of the abdomen showed a scar in the right lower quadrant, probably a pararectal incision, 3 inches in length, extending downward from the level of the umbilicus. At its lower angle there was a raised area the size of a quarter which appeared to be mucous membrane. The surrounding area showed inflammatory reaction due to discharge from the fistulous tract. The discharge was fecal in character (Fig. 499).

Examination of the fistula showed direct connection with the bowel, with no apparent accessory fistulæ or sinuses.

Roentgenographic examination was not followed out because of the easy demonstration of the fistulous area.

The operation was carried out under local anesthesia at the patient's request. The area was thoroughly cleansed and the opening of the fistula closed by a row of uninterrupted sutures to prevent further soiling of the operative area temporarily.

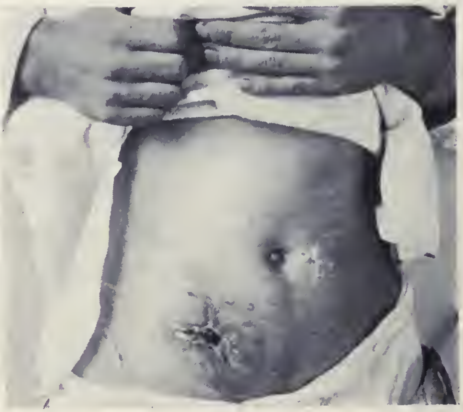

Fig. 499.—Photograph before operation showing fecal fistula in abdomen.

An elliptic incision was made about the external opening of the fistula, carrying it down to the peritoneum. The large bowel was then freed and brought up into the field. The opening in the bowel which involved more than half of its circumference was sutured definitely after removal of temporary sutures, a transverse section, and peritoneal surface sutured separately over the united edges of the fistula. Considering the inability to keep the field aseptic, a small drain was inserted into the neighborhood of the united bowel. The peritoneum and fascia were closed with interrupted sutures over the bowel. The skin

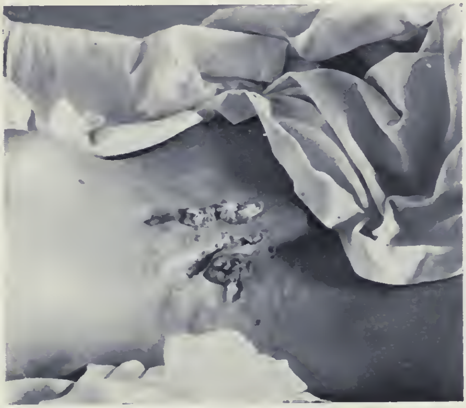

Fig. 500.—Photograph showing application of lead plates to bring wound borders together.

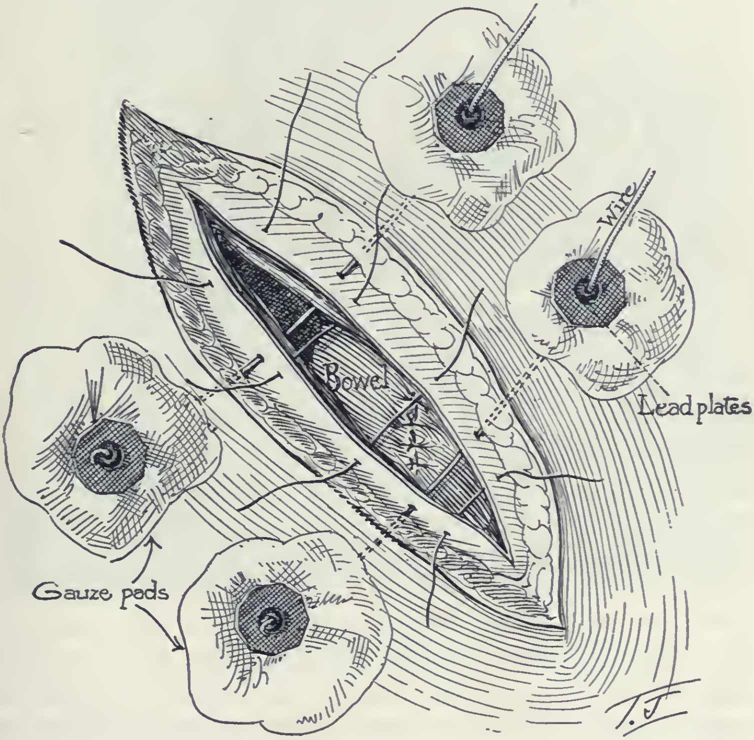

Fig. 501.—Diagrammatic sketch showing application of lead plates.

was excised so as to get broad surfaces together. Primary union was not expected, but when the bowel is sutured and kept far below the fascia so that it cannot adhere to the skin (lip fistula) a fistula will usually close by secondary union.

The patient remained free from any further suggestion of recurrence until the sixth day, when the swelling over the wound again appeared. The skin sutures were removed and a fecal discharge appeared. Our repair had not been a success primarily. There appeared a broad separation of the wound borders, and one week later under local anesthesia a closure was again made. The bowel was again sutured—deep fascia imbricated over the area and two silver wires passed transversely over the fascial imbrication, the wires passing several inches beyond the wound margins, engaging the fascia laterally and passing outward through the skin (Fig. 501). By this means tissues were brought forcibly together over the area of intestinal repair. The wires were held in place by large plates to distribute the tension over greater skin surface (Fig. 500).

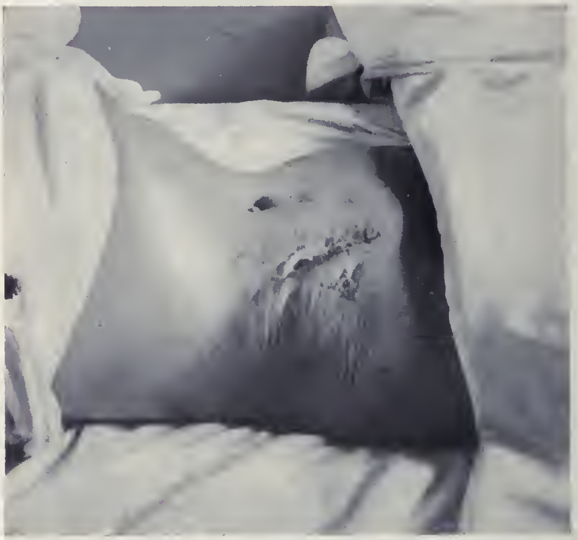

Fig. 502.—Photograph after operation showing wound completely healed.

Following the second closure there was no further fecal discharge, and on the ninth day the silver wires were withdrawn (Fig. 502).

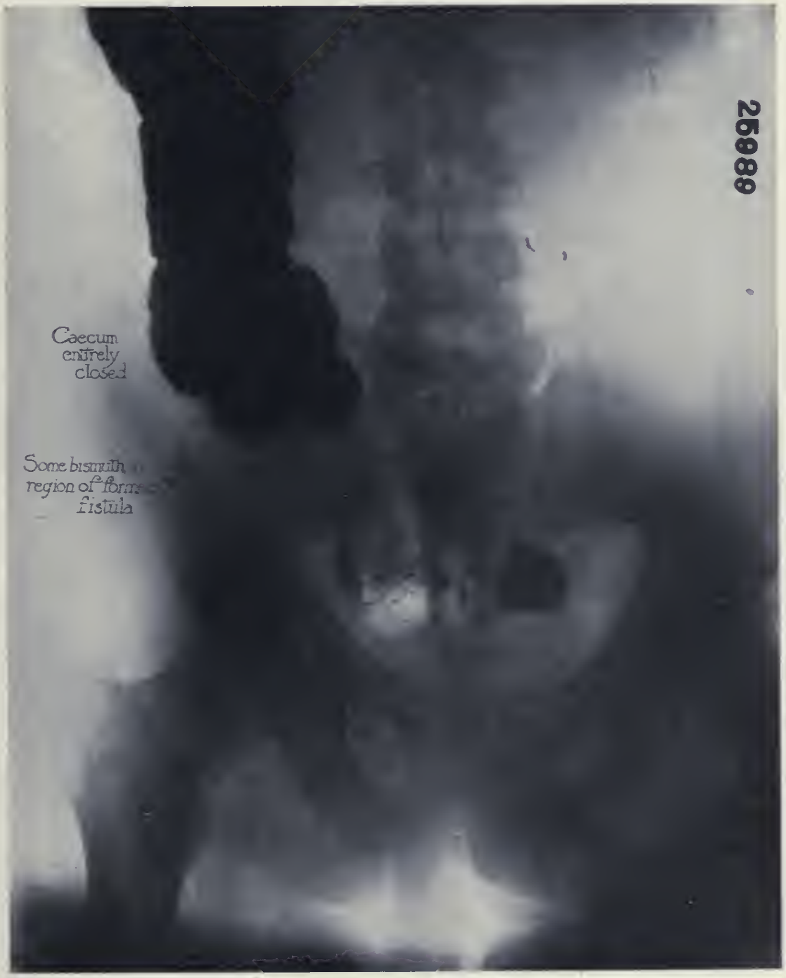

Fig. 503.—Roentgenogram after operation showing cecum filled with bismuth and former fistula closed.

This case is of interest in that a fistula involving the major portion of lumen of bowel is often treated by resection, which by above procedure was obviated. Subsequent Roentgen examination failed to reveal any indication of stricture of the bowel at point of repair (Fig. 503).

The case is also clinically remarkable, for it teaches us not to use drainage of hard material, particularly glass, for too long a period because of the danger of pressure necrosis.

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CONTENTS

PAGE

Donald C. Balfour
THE USE OF THE ACTUAL CAUTERY IN TREATING BENIGN LESIONS OF THE STOMACH AND DUODENUM 1233

Fred W. Rankin and Charles H. Mayo
GASTROJEJUNOCOLIC FISTULAS FOLLOWING GASTRO-ENTEROSTOMY 1241

Charles H. Mayo
THE FORMATION OF A CLOACA IN THE TREATMENT OF EXSTROPHY OF THE BLADDER ... 1257

Verne C. Hunt
A HUGE DIVERTICULUM OF THE BLADDER 1267

E. Starr Judd
ADENOMYOMA PRESENTING AS A TUMOR OF THE BLADDER 1271

E. Starr Judd, Hermon C. Bumpus, Jr., and Albert J. Scholl, Jr.
PROGNOSIS IN CASES OF CARCINOMA OF THE PROSTATE DISCOVERED AT OPERATION 1279

Louis B. Wilson
ILLUSTRATIVE CASES OF MALIGNANT TUMORS OF THE THYROID 1291

William J. Mayo
SPLENIC SYNDROMES 1307

Harry H. Bowing
HODGKIN'S DISEASE TREATED BY RADIUM AND THE x-RAY: REPORT OF FOUR CASES 1327

Alfred W. Adson
TREATMENT OF BRAIN TUMORS 1343

Walter I. Lillie
OCULAR PHENOMENA IN CASES OF CHIASMAL LESIONS NOT OF PITUITARY ORIGIN: REPORT OF SIX CASES 1363

Harold I. Lillie
OBSERVATIONS IN THE MANAGEMENT OF CHRONIC FRONTAL SINUSITIS WITH EXTERNAL MANIFESTATIONS: REPORT OF TWENTY-TWO CASES 1381

Gordon B. New
RHINOPHYMA. RHINOSCLEROMA 1393

Albert C. Broders
EPITHELIOMA OF THE EAR. A STUDY OF SIXTY-THREE CASES 1401

Carl A. Hedblom
PRIMARY TUBERCULOUS PERICARDITIS 1411

Ambrose L. Lockwood
DEVELOPMENT AND POSSIBILITIES OF THORACIC SURGERY 1425

James C. Masson and Edmund J. Horgan
RETROPERITONEAL LIPOMAS: REPORT OF TWELVE CASES 1451

Frank C. Mann
THE TRANSPLANTATION OF FAT IN THE PERITONEAL CAVITY 1465

Verne C. Hunt
ACUTE CONDITIONS OF THE ABDOMEN 1473

Melvin S. Henderson
INCISIONS IN THE KNEE-JOINT 1483

Henry W. Meyerding
HEMORRHAGIC CYST OF THE UPPER LEFT FEMUR. HEMORRHAGIC CYST OF THE UPPER RIGHT FEMUR. OSTEOMALACIA. NON-UNION OF THE LEFT TIBIA ASSOCIATED WITH SYPHILIS. PERIOSTEAL SARCOMA INVOLVING THE RIGHT KNEE-JOINT 1493

Walter E. Sistrunk
CANCER OF THE BREAST 1503
CYSTS OF THE THYROGLOSSAL TRACT 1509
TUMOR OF THE PAROTID GLAND 1515
ELEPHANTIASIS 1523

Mayo Clinic Number

THE SURGICAL CLINICS
OF
NORTH AMERICA

VOLUME 1 NUMBER 5

THE USE OF THE ACTUAL CAUTERY IN TREATING BENIGN LESIONS OF THE STOMACH AND DUODENUM

DONALD C. BALFOUR

THE aphorism of Hippocrates 2000 years ago, "What cannot be cured by fire is incurable," indicates the value the ancients placed on the actual cautery. For centuries it has been used as a hemostatic, sterilizer, and counterirritant, and it is one of the few therapeutic agents of antiquity which has persisted to modern times. In the present era of medicine and surgery further contributions have been made to our knowledge of the value of the cautery, one of the most important being a better appreciation and understanding of its effect on the malignant cell. It is now known, largely through the work of Percy, that not only does heat possess the power to destroy the malignant cell but also that it may be utilized to accomplish this without devitalizing healthy tissue.

In the Clinic for many years the actual cautery has been used routinely in many conditions. For example, it is applied to the edges of the stomach or intestine after removal of malignant growths, and this practice has undoubtedly been an important factor in the 25 per cent. five-year cures which have followed resection of the stomach for cancer and the 35 per cent. five-year cures which have followed resection of the intestine for cancer. In malignant neoplasms of the bladder cauterization gives excellent results, as Judd has recently pointed out; in the mouth, tongue, and jaws it is of great value, as New has shown, and its efficiency in epitheliomas of the skin is well known. In many cases of non-malignant inflammatory diseases, such as carbuncles, chronic indolent ulcers, and intractable infections of the skin, the cautery brings about healing when all previous treatment has been ineffectual. Whenever sterilization is required, heat is the most dependable of all agents.

It is quite natural, therefore, because of the striking effect of heat on malignant and non-malignant ulceration that the use of the cautery should be adopted in the treatment of chronic ulcerations in the stomach and duodenum. In 1913 we began the use of the actual cautery in the Clinic in selected cases of gastric ulcer, and it has now become the most frequently employed procedure in the Clinic in the surgical management of gastric ulcer, and has also been found applicable to certain types of duodenal ulcer. The results have been most gratifying. Up to July, 1921 the cautery had been used in 437 cases of gastric ulcer in the Clinic. There has been an operative mortality of 1.87 per cent. in this series, less than half the average mortality rate of all other types of operations for gastric ulcer in the Clinic, and at least 80 per cent. of the patients have been afforded relief from symptoms, while the subsequent death-rate has been considerably lower than the average subsequent death-rate following all other operations. The latter fact is very significant, since it is to some extent, at least, due to the specific destructive action which heat possesses for the cancer-cell. The outstanding facts in the results of cautery excision and gastro-enterostomy for ulcer of the stomach are the low operative mortality, the absence of postoperative morbidity, the high percentage of satisfactory symptomatic results, and the low incidence of late sequelæ. The cautery has been particularly effective in destroying the bleeding type of ulcer, both gastric and duodenal, and the routine destruction of these ulcers has eliminated almost entirely the occurrence of subsequent gastric hemorrhage.

Experience with the cautery has shown that it is most applicable to the small ulcer on or involving the lesser curvature. In speaking of the size of an ulcer, the size of the crater is referred to. If the crater is not more than 1 cm. in diameter the cautery can be most satisfactorily used whatever the extent of the induration around the crater may be. Cautery excision and gastro-enterostomy have been performed in more than 100 cases of ulcer of this type in the Clinic without operative mortality and with excellent subsequent results. Since these small ulcers on the lesser curvature are the type most commonly encountered, often cautery excision can be employed, and indications for the procedure may be anticipated in even more cases, if one may judge by the steady decrease in the number of chronic ulcers coming to operation in which delay has been responsible for those complications, which add hazard to any operative treatment and doubt as to the result. It has been in cases of this latter type that the immediate or late deaths following cautery excision and gastro-enterostomy have occurred, since in seeking to establish the limitations of cautery excision the operation has been employed occasionally in fixed ulcers with such large craters that gastric resection would have been preferable had it not been contraindicated because of its difficulty and risk under the existing conditions. Yet it has also been in such cases that most remarkable results have followed the thorough cauterization of the lesion. The situation of the ulcer occasionally makes even cautery excision difficult, but only very rarely is an ulcer so high on the lesser curvature that it cannot be destroyed safely with the cautery. The value of the cautery in the bleeding type of ulcer has already been mentioned. In ulcers of the posterior wall of the stomach the cautery is used either for a transgastric excision or for the cauterization of the edges of the opening of the stomach after it has been separated from the pancreas. On the anterior wall the cautery is a very safe and simple method of excising an ulcer.

TECHNIC

The technic of cautery excision of gastric ulcer as it is now carried out in the Clinic is essentially the same as that originally proposed. The ulcer is elevated by a finger hooked around the lesser curvature, and a flap of gastrohepatic omentum, which is invariably thickened over the site of the ulcer, is carefully dissected off (Fig. 504). If this dissection includes the thickened peritoneal coat of the stomach, often a grayish-black spot is found, which is the external opening of the chronic perforation which develops in many chronic gastric ulcers (Fig. 504). The tract of the perforation is sometimes tortuous, but it usually leads to the center of the crater of the ulcer, so that a probe carried through the fistula into the cavity of the stomach serves as a guide for the direction of the cautery through the gastric wall. Experience will soon show the necessity of being absolutely certain of the size and location of the crater of the ulcer before the perforation is made with the cautery. Some of the few instances in which the crater of the ulcer has been missed by the cautery have undoubtedly been due to overlooking this important fact. After the crater of the ulcer has been located and outlined

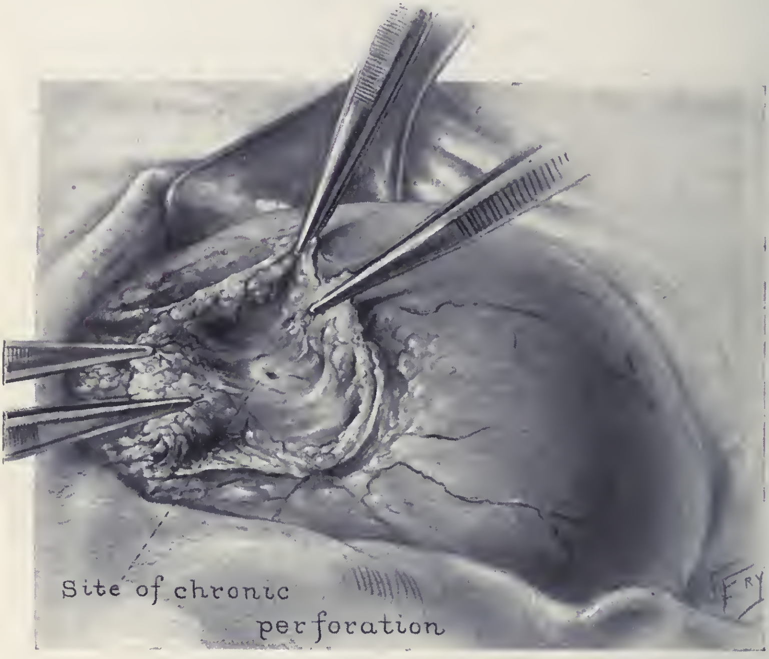

Fig. 504.—Reflection of the gastrohepatic flap exposes the perforation, often a grayish-black spot.

exactly and the peritoneal surface prepared for the application of the cautery, the tension which has been maintained by the finger elevating the lesser curvature of the stomach is released, and small catch forceps are placed to encircle the indurated area in the manner shown in Fig. 505. If the portion of the stomach including the ulcer is elevated by the forceps the ulcer may be burned out without danger of the point of the cautery coming in contact with healthy mucosa at any other point of the wall of the stomach. A Paquelin or electric cautery heated a dull red is applied at the point which marks the site of the per-

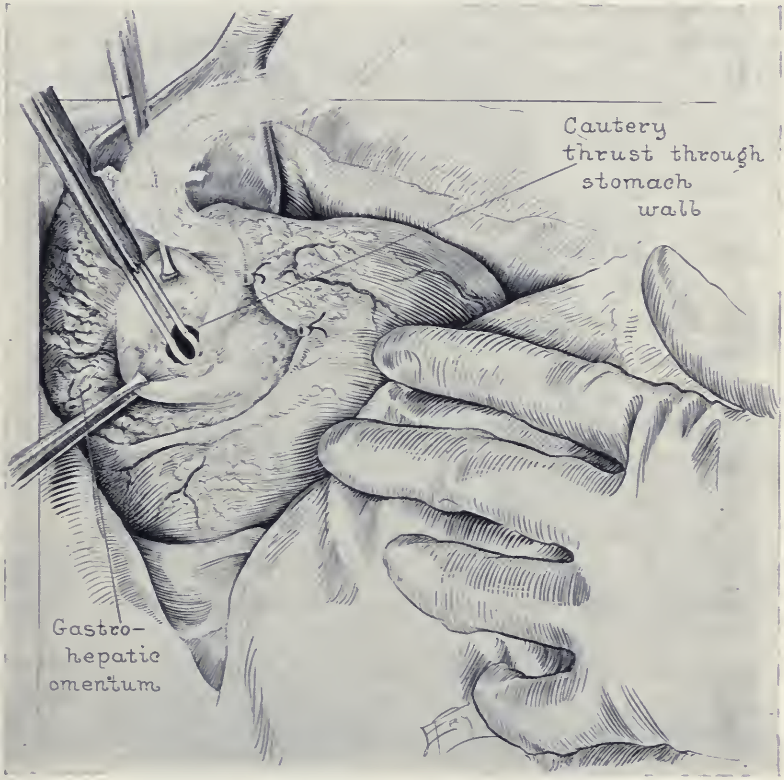

Fig. 505.—The region of the ulcer is elevated and the wall of the stomach at the site of the ulcer is burned through.

foration, or if this is not evident, at a point which apparently corresponds to the center of the crater of the ulcer; it is carried slowly through the base of the ulcer until the wall of the stomach is perforated completely. The cautery is then manipulated until the size of the opening which has been burned corresponds to, or is larger than, the crater appeared to be (Fig. 505). The surrounding tissue may then be heated thoroughly without increasing the size of the opening, and the selective action of heat on any actual or potential cancer-cell utilized. The vulnerability of the cancer-cell to heat is five times as great as that of the normal cell. Cautery excision, therefore, possesses distinct advantages in the few ulcers in which early malignant degeneration has already taken place. If all malignant or potentially malignant cells are not removed in the excision it is likely that the heat will destroy those remaining; moreover, there is little or no danger of the dissemination of cancer-cells by the cautery. Another advantage of cautery excision is that the opening, which is approximately the size of the crater, is considerably smaller than that which would have remained after knife excision of the entire indurated area. This induration disappears when the central point of infection is destroyed, just as it does when chronic ulceration in any other part of the body is dealt with in this way. There is no active hemorrhage when cauterization is carried out slowly, so that no vessels need be ligated individually.

The opening is closed by interrupted sutures of chromicized catgut and reinforced by a continuous suture of the same material (Fig. 506). The flap of gastrohepatic omentum is then sutured to the wall of the stomach so that it thoroughly protects and conceals the side of the closure (Fig. 507). The operation is completed by a posterior gastro-enterostomy.

This general plan of procedure is applicable to all ulcers along the lesser curvature. The larger the crater, the more extensive the burning, particularly in cases in which it has not been possible positively to exclude malignancy and in which gastric resection does not seem warranted. The plan of taking a substantial slice from the base of the ulcer in doubtful cases and subjecting it to immediate microscopic examination is a practice in the Clinic which has proved to be a valuable precaution, and is quite permissible when thorough destruction of the ulcer is carried out immediately.

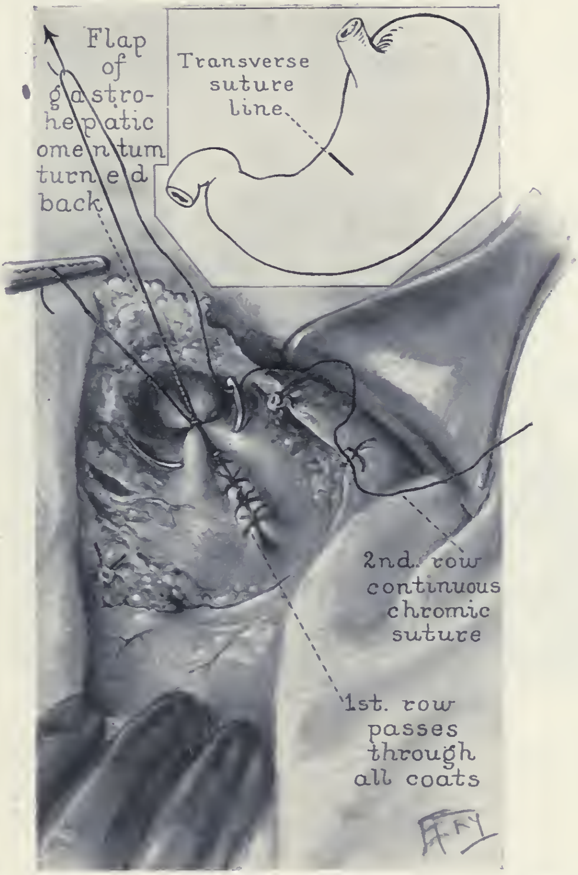
Flap of gastro-hepatic omentum turned back
Transverse suture line
2nd. row continuous chromic suture
1st. row passes through all coats
FAY

Fig. 506.—The cauterized area is closed by a row of interrupted sutures and the suture line covered by a continuous suture.

In duodenal ulcers practically only a puncture with the cautery is required because the actual lesion is so clearly in view and the ulcer crater is usually small. Thus far we have used the cautery chiefly in the bleeding type of ulcer in the duodenum;

that is, the ulcer which has been associated with a history of gastric or gastro-intestinal hemorrhages. The perforation of such an ulcer with the cautery added to the routine gastro-enterostomy apparently has prevented the danger of subsequent hemorrhages.

In ulcers of the posterior wall the cautery cannot be used in the same manner as for ulcers of the lesser curvature, because of their situation and because of the frequency with which they are attached to the pancreas. The method which is preferred in the Clinic for dealing with these ulcers is the preliminary separation of the stomach and pancreas through an opening in the gastrohepatic omentum, thoroughly heating the edges of the opening in the stomach, and searing over the inflammatory area of the pancreas which has formed the basis of the ulcer. The gastric defect is then closed and a gastro-enterostomy made.

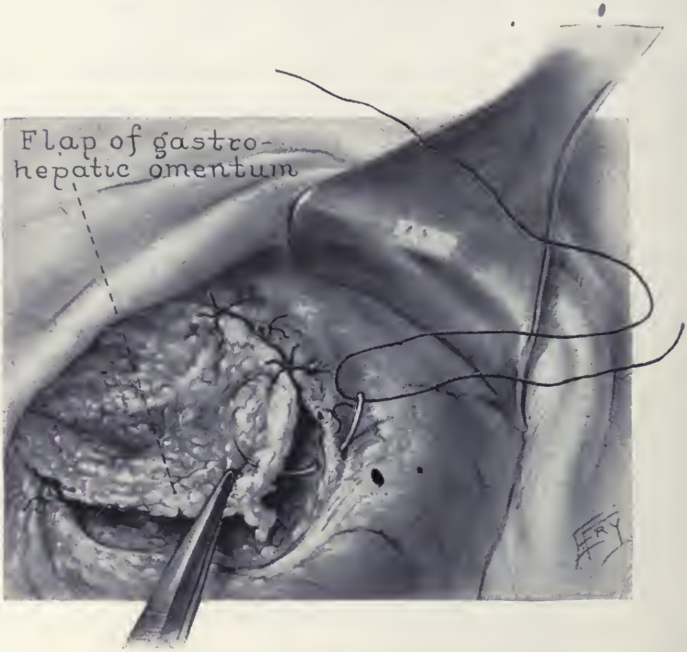

Fig. 507.—The flap of gastrohepatic omentum is sutured over the first suture line by interrupted stitches.

GASTROJEJUNOCOLIC FISTULAS FOLLOWING GASTRO-ENTEROSTOMY

FRED W. RANKIN AND CHARLES H. MAYO

GASTRO-ENTEROSTOMY for the relief of symptoms of duodenal ulcer and in conjunction with other surgical procedures, such as cautery destruction or knife excision of gastric ulcers, gives perhaps as high a percentage of permanent relief as any surgical procedure which changes physiologic conditions to permit nature to effect a cure, but does not directly attack the pathologic lesion. Moynihan has attributed the vast majority of failures following gastro-enterostomy to three causes: (1) Absence of an intrinsic lesion in the stomach or duodenum, (2) an incomplete operation which leaves a diseased organ, such as the appendix or gall-bladder, which acts as a focus for recurrent infection, and (3) technical failures.

The formation of a gastrojejunal or a jejunal ulcer which results from one or more of the foregoing causes, or from other causes not yet observed, presents a picture so uniform in its symptomatology that a careful history and Roentgen study make accurate diagnosis comparatively certain. A search of the literature fails to reveal other adequate causes, although since the syndrome of this sequel to gastro-enterostomy has been understood it has attracted much attention. The incidence of gastrojejunal ulcer following gastro-enterostomy is within 1 to 3 per cent., and it seems likely that a better understanding of its nature and perfected roentgenologic technic will increase this percentage at the expense of the group of so-called relapsing ulcers of the duodenum or stomach. Bolton and Trotter, Eusterman, and others are authority for the statement that 10 per cent. of gastrojejunal ulcers cause gastrocolic fistulas or gastrojejunocolic fistulas, as the case may be.

The first case of gastrocolic fistula reported was in 1903, published by Czerny, and in 1907 Port and Reitzenstein reported a case of gastrojejunocolic anastomosis. Since that time 34 cases have been reported in the literature and reviewed by Boulton and Trotter, who had 4 cases of their own.

In 101 cases of ulcer at or near the gastrojejunostomy anastomosis (reported by Judd) in which operation was performed at the Mayo Clinic, 6 fistulas between the stomach and bowel were found. This percentage of incidence is much the same as that of other observers who place it at from 1 to 2 per cent. In 55 of these cases the primary operation had been performed in the Clinic, and in 46 it had been performed elsewhere. All of our cases of gastrocolic fistula occurred in males, a fact not surprising when it is remembered that the ratio of males to females with jejunal ulcer is 7 to 1, while with primary duodenal ulcer it is 2½ to 1 (Eusterman).

ETIOLOGY

In seeking an explanation for postoperative fistula between the stomach and bowel it seems logical to attempt to ascertain the causative factors of both the primary ulcer for which the gastro-enterostomy was made and the jejunal ulcer whose extension causes the pathologic anastomosis. Trauma to the operative field is suggested as a possible cause of jejunal ulcer and must be given some consideration, but a number of cases are reported in which clamps were not used on either the stomach or bowel during the anastomosis. The location of the ulcer below the anastomosis on the efferent loop about 10 cm. from the stoma is also evidence against this. In the Clinic series of 101 cases, 8 ulcers were definitely in the jejunum and 1 was 10 cm. below the gastro-enterostomy opening.

The formation of these ulcers is most frequently ascribed to mechanical factors, and yet without much direct evidence to substantiate the contention. The discussion as to the adaptability of the long-loop or the no-loop operation has caused surgeons to recognize that certain basic principles must be carried out to insure the greatest success, and most agree that the anastomosis should be made without a jejunal loop, that the stoma on the gastric side should be at the lowest point on the greater curvature, that the suture material used should be absorbable, and that postoperative alkalinization and adherence to prescribed diet should be insisted on. Inaccuracy in carrying out the technical details of the anastomosis unquestionably leads to trauma which, if prolonged and active, must play some part in the unfortunate postoperative sequelæ. That unabsorbable suture material may have been a possible etiologic factor must be admitted, and yet, since the adoption of chromicized catgut as the approximation suture, jejunal ulcers have continued to form. In the 55 cases in our series in which the primary operation had been performed in the Clinic, nonabsorbable material was found in 9, and in the 46 cases in which the primary operation had been performed elsewhere nonabsorbable material was found in 17. Generally it is embedded in the mucous layer of the stomach or jejunum and presents in the stoma, often as much as 1 cm. or more of silk being free in the opening. Discarding such material has no doubt greatly reduced the frequency of ulcers at the stoma, although its importance as an etiologic factor can easily be overestimated.

Most observers are agreed that infection plays the principal part in the formation of ulcers at or near the gastro-enterostomy stoma. The cut tissues are constantly exposed at the time of operation and during the process of healing, which, as Flint has shown, requires an average of fourteen days. Judd calls attention to the primary ulcer as the possible source of infection from which the abraded mucous membrane of the stoma may receive its bacteria, but he also points out that in 15 of the cases in his series there was no evidence of a primary ulcer. Whether or not there had been a primary ulcer, or whether it had been in the mucosa on the posterior wall, is problematic, but there was no visible scar on the mobile portion of the duodenum inspected. Moynihan has made similar observations in 2 of his cases. The inference is that no particular type of infection is essential, but that some remote source, such as the teeth, tonsils, antra, nasopharynx, gall-bladder, and appendix may be the underlying source.

There are no recorded cases of ulcer developing at the suture line of a plastic operation about the pylorus, nor has a resection of the stomach for cancer or ulcer been followed by this sequel. Judd points out that the principal cause may be the action of the acid gastric juice on the jejunal mucous membrane, which, unlike the duodenum, is unaccustomed to receiving acid secretions. In the majority of cases of duodenal and gastric ulcers there are hyperacidity and hypersecretion, and these, unneutralized by bile and pancreatic juice, can readily have a deleterious effect on the jejunal mucosa.

SYMPTOMATOLOGY

The clinical manifestations of these fistulas usually are preceded for an indefinite time by the symptoms common to jejunal ulcer, a sudden onset of colic and diarrhea, which may or may not be accompanied immediately by vomiting of stercoraceous material and belching of foul-smelling gas. Later, when the opening becomes larger, the latter symptoms are constant, and invariably are followed by severe wasting and great emaciation, although the patient usually continues to have a ravenous appetite. The jejunal ulcer may occur as soon as five weeks after operation or as late as nine and a half years, in spite of rigid ulcer management and continued alkalinization. Usually the symptoms appear within from six months to a year after operation; in the interval between the patient is comfortable and free from pain and distress. The onset is gradual and insidious and relief is not obtained as formerly by food and alkalies. Usually following such an onset the fistula between the colon and bowel is announced by a sudden attack of pain, diarrhea, and fecal vomiting. The diarrhea is produced at once on the entrance of food into the stomach and is lienteric; marked emaciation rapidly ensues. That this picture is not constant, however, is demonstrated in Case 306,138. The fistula sometimes is incomplete and apparently closes for months at a time, to open and bring about a remission of symptoms.

Pain is not a symptom on which great dependence can be placed, since it is usually intermittent and more often lower in the abdomen than the pain of the original duodenal ulcer. Not infrequently it is confined to the lower left quadrant, a fact for which no very satisfactory explanation seems to have been evolved. A palpable mass is almost always felt near the umbilicus, especially if the condition is of long standing.

The Roentgen ray is an invaluable aid in the diagnosis of this condition and is very accurate in calling attention to the fistula. In the 6 cases herewith reported the diagnosis has been confirmed by Roentgen ray and demonstrated at operation in each case. In jejunal ulcer the Roentgen ray is accurate in more than 75 per cent. of the cases.

TREATMENT

Obviously the treatment of this condition is surgical, since a fistula which exists in such an infected tract can scarcely be expected to heal spontaneously. Three distinct problems present themselves for consideration in mapping out a plan to deal with this condition: (1) How may the fistula be eradicated most easily? (2) What measures shall be employed in dealing with the gastrojejunal or jejunal ulcer which caused the perforation? (3) What, if anything, shall be done to the original ulcer? Since the patient is emaciated and weakened, and formidable procedures, such as resection, which necessarily carry a relatively high mortality even in robust patients, are more liable to result fatally than more simple ones which offer almost as many chances for relief, it seems fairly generally accepted that patients who once develop an ulcer at the stoma tolerate a gastro-enterostomy poorly, and that better results are ultimately obtained if their gastro-enterostomy is undone and some other means of treating the original ulcer attempted. Trotter disagrees with this statement, and believes that better results are obtained by leaving the gastro-enterostomy after having obliterated the fistula. He also suggests a cecostomy as a possible safety-valve on the fistulous tract after repair. When a fistula is present a tumor mass is usually felt at the site of the anastomosis, owing to edema and thickening of the tissues at the base of the mesentery of the transverse colon which contains the original stoma ulcer. The contraction which follows, plus the thickening in the tissues of the mesocolon, tends to pull the transverse colon into the line of anastomosis where it becomes fastened by the ulcerative process, and only requires a progression of the ulceration and necrosis to produce a communication into the adjacent viscera (Figs. 508–510).

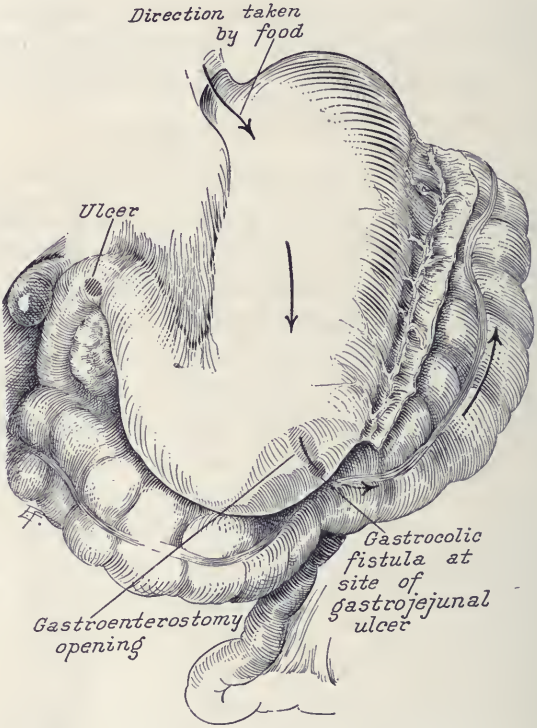
Direction taken by food
Ulcer
Gastrocolic fistula at site of gastrojejunal ulcer
Gastroenterostomy opening

Fig. 508.—Fistula formed by a gastrojejunal ulcer.

Perhaps the old method of suturing the rent in the mesocolon to the anastomosis may have favored the formation of the fistula, and the present tendency to suture the opening to 2.5 cm. above and on the stomach side may be preventive of this unfortunate result. By carefully dissecting down on the line of anastomosis a cleavage generally can be found which leads to the stomach, and from there the colon can be dissected free and the fistulous tract divided and inverted on both ends. This is much simpler than a massive resection and is a plan which we have been able to carry out in all our cases with one exception, in which a resection was made and followed by a gastro-

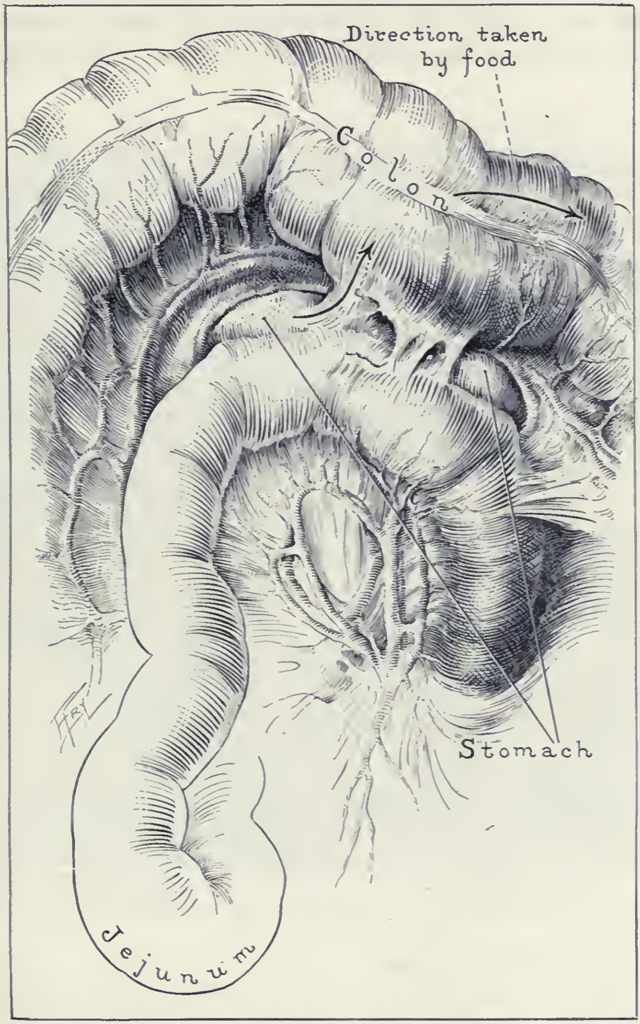

Fig. 509.—The under surface of the mesocolon. The colon attached to the site of the gastro-enterostomy.

enterostomy some months later. In one case an anastomosis was made between the stomach and duodenum after the original ulcer had been destroyed and the jejunal ulcer excised. If it is possible to mobilize the original duodenal ulcer it should be excised with or without pyloroplasty, as seems best (Figs. 511–513).

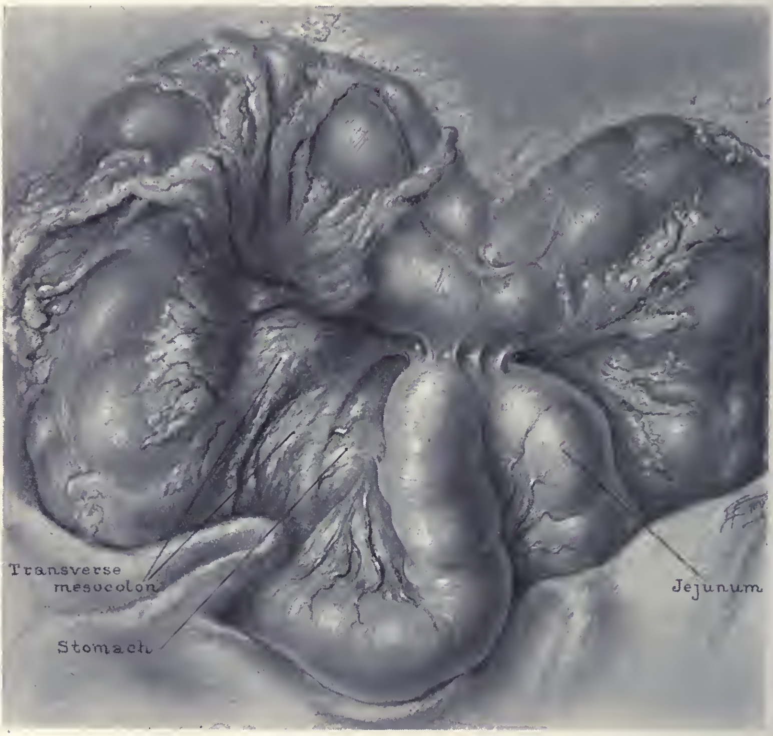

Fig. 510.—Adhesions around the gastrojejunocolic fistula uniting the colon to the gastro-enterostomy.

In the 31 cases of fistula reported by Bolton and Trotter the mortality was not high considering the seriousness of the condition: 27 patients were operated on; 21 recovered. Four patients were not operated on, and died. In 2 of the patients who died following operation, however, the fistula was not repaired. In our series there has been no operative death. The only patient who is not living died two years after operation from an intercurrent disease.

Case I (A7152).—Mr. H. A. S., aged sixty years, came for examination August 5, 1912. He had had stomach trouble for twenty years, about once a month spells of belching, sour stomach, pain around the umbilicus, and occasionally vomiting. He had used a stomach-tube two or three times daily for twelve years. He had been operated on elsewhere six years previously and told that he did not have ulcer, but an atonic, dilated stomach. Following the operation he had been well for eighteen months and

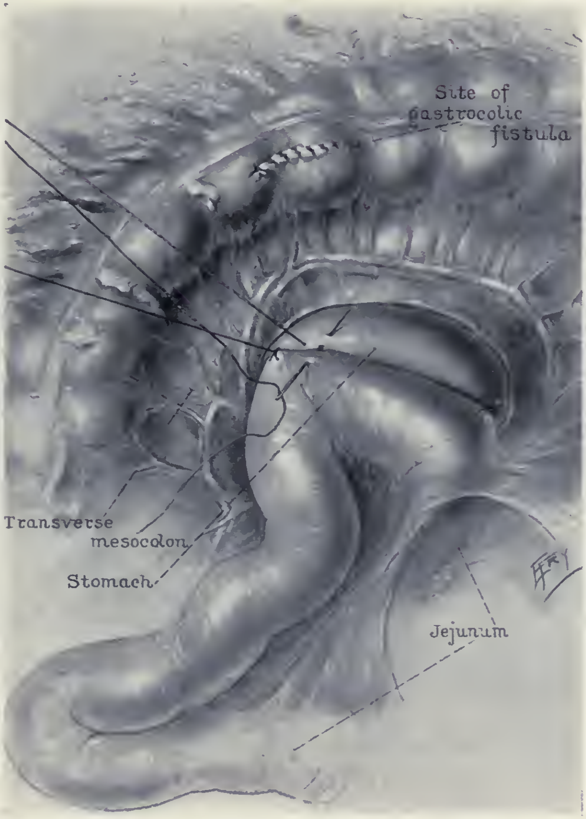

Fig. 511.—The repaired fistula and the beginning of a new gastro-enterostomy.

had gained 60 pounds. Then the symptoms returned with pain severe enough to require a hypodermic at times.

Stomach washings at the time of examination showed food remnants and quantities of yellow fluid with marked fecal odor. Urinalysis was negative.

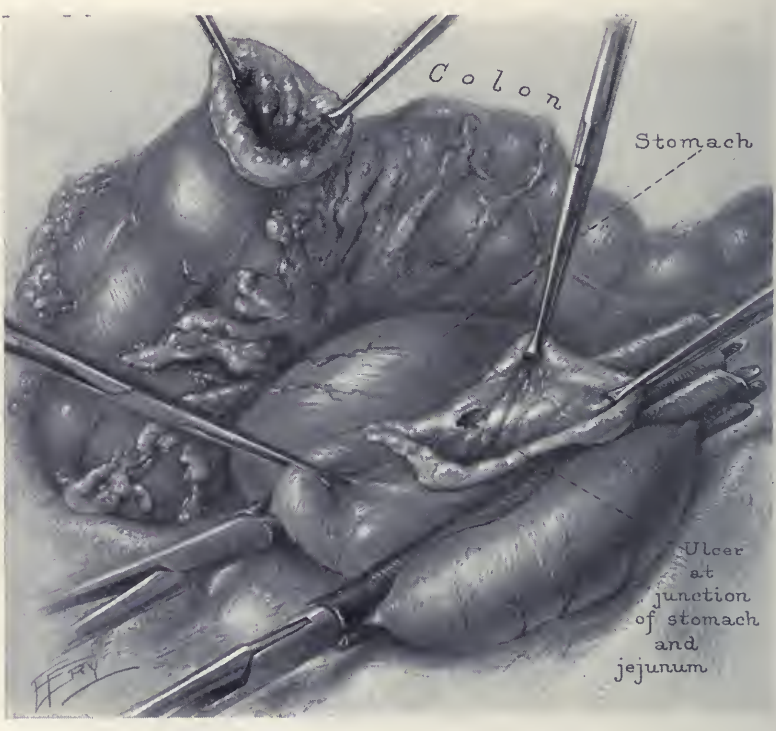

Fig. 512.—The gastro-enterostomy opened, exposing an ulcer at the line of the juncture. The colon cut from the gastro-enterostomy and held open.

At operation, August 12, 1912, a contracted duodenal ulcer and a colic fistula were found at the point of anastomosis between the transverse colon and the jejunum and a fistula between the transverse colon and the stomach. A Roux gastro-enterostomy was made. Ten cubic centimeters of the transverse colon were resected with end-to-end suture, and 10 cm. of jejunum at the site of the fistula with end-to-side anastomosis between the proximal short jejunum and the distal end of the jejunum. The distal end of the jejunum was anastomosed to the posterior wall of the stomach at the site of the original gastro-enterostomy.

Convalescence was uneventful. According to the message from his relatives the patient died April 24, 1914 from acute nephritis.

Case II (A122,474).—Mr. J. N. A., aged thirty-four years, came for examination January 3, 1916. He had had a gastro-enterostomy for duodenal ulcer performed in the Clinic in 1915.

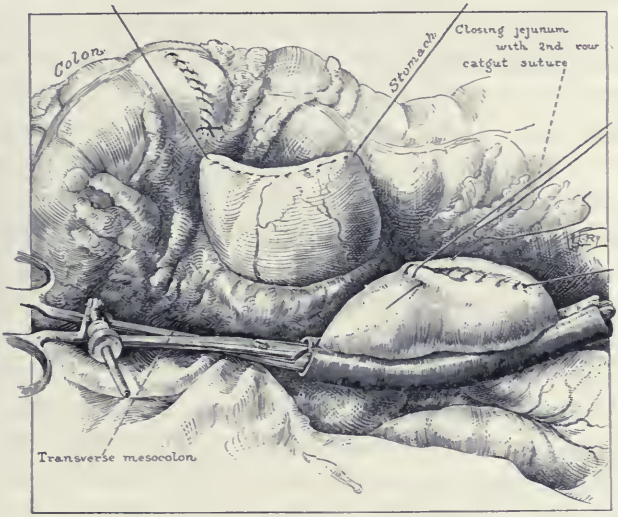

Fig. 513.—Colon, stomach, and jejunum closed.

He was free from symptoms for two or three months following operation, then he suffered from nocturnal vomiting, with bile in the vomitus, pain in the left epigastrium and chest, tenderness, and loss of weight and strength.

A 250-c.c. specimen of vomitus showed total acids 70, free acid 50, food remnants 1, and blood 1, on a scale of 1, 2, 3, 4, but no bile. The stomach emptied in seven hours. The urinalysis was negative.

February 22, 1916 a gastrojejunal ulcer involving the outer wall of the right upper side of the stomach was excised, the gastro-enterostomy cut off, and a partial resection of the jejunum performed, with end-to-end anastomosis.

April 5, 1919 a posterior gastro-enterostomy was made for the bleeding type of ulcer involving practically the entire first portion of the duodenum. The pylorus was occluded. The ulceration was too extensive to warrant resection or local treatment. Considerable obstruction was present. The area of the former closure of the gastro-enterostomy and the anastomosis in the jejunum were in good condition.

A slight bronchopneumonia complicated his convalescence; however, the patient was able to leave the hospital on the fifteenth day following operation and was discharged from our care in good condition eighteen days later.

Case III (A118,945).—Mr. J. J. S., aged thirty-seven years, came for examination March 28, 1917. He had had a gastro-enterostomy performed in our Clinic November 17, 1914 for duodenal ulcer; he was well for eighteen months afterward and gained 25 pounds in weight. In September, 1916 he had a hemorrhage from the stomach, when he vomited about 2 quarts. He had pain in the abdomen every afternoon which could be relieved by food.

At the time of examination the patient was 30 pounds underweight. His bowels were constipated. The urinalysis was negative. The hemoglobin was 85 per cent. The stomach contents showed combined acids 54, and free hydrochloric acid 44. A roentgenogram showed the stomach to be adherent to the abdominal wall. A diagnosis of gastrojejunal ulcer was made.

At operation, May 2, 1917, an ulcer was found between the jejunum and the transverse colon with a small fistula into the colon. The old gastro-enterostomy was cut off and the fistula closed. A gastroduodenostomy was made.

Convalescence was uneventful. The patient was discharged from the hospital on the tenth day, and from our care nine days later.

Case IV (A272,499).—Mr. H. L. J., aged twenty-seven years, came for examination May 27, 1919. He had had an appendectomy in 1908 and gastro-enterostomy in 1909, which for two years relieved the low abdominal pain and vomiting from which he had suffered off and on since childhood. The pain returned in 1911, but was controlled by diet. Symptoms began again in 1917, with the sensation of fulness or heaviness at the umbilicus, belching of foul gas, and some vomiting after meals. The bowels had been loose for the past six years. He had lost 35 pounds in weight in six months.

The patient's chief difficulty at the time of examination was loss of weight and strength, general lassitude, and occasional vomiting of material with a fecal odor. He was markedly emaciated. Urinalysis was negative. The hemoglobin was 75 per cent., the leukocytes 5600. The total combined acids in the stomach contents were 90, and free acid 76. Roentgen examination showed the gastro-enterostomy. A diagnosis of gastrocolic fistula was made.

Exploration, June 20, 1919, revealed an ileocolostomy and a portion of the small intestine united by lateral anastomosis to the transverse colon; the small gastro-enterostomy had perforated on to the colon through a gastrojejunal ulcer. Many adhesions were found in the upper portion of the abdomen and considerable scarring about the pylorus. The structures were separated and the openings in the ileum and colon closed. The openings in the stomach were converted into one and a new gastro-enterostomy made. The patient was dismissed from the hospital on the eleventh day and from our care twenty-three days later in good condition. He has not been heard from since.

Case V (A66,081).—Mr. J. M., aged forty-nine years, came for examination January 1, 1920, with a history of appendectomy and cholecystostomy in 1909, and gastro-enterostomy in 1912, following which he had been well for six years. Two years before examination he had had a sudden spell of unconsciousness followed by vomiting and diarrhea, and watery stools every half-hour for three days. Spells of diarrhea, nausea with dull aching, and pain in the upper right quadrant of the abdomen recurred every three months and increased in severity. They had no relation to food intake. The patient had some dyspepsia between attacks. The later attacks had been characterized by belching of sour gas, with the odor of fecal matter, and some vomiting of fecal material. At times there was blood in the stools.

The urinalysis was negative. The hemoglobin was 78 per cent., the leukocytes numbered 9200. The test-meal revealed total acids 22, free hydrochloric acid 16, and mucus 2 on a scale of 1, 2, 3, 4. The Roentgen examination revealed a gastrocolic fistula.

At operation, December 21, 1920, a perforating gastrojejunal ulcer with a gastrocolic fistula was found, but no evidence of any foreign material. The stomach was dilated and scarred on the anterior surface. There was considerable inflammatory exudate. The old gastro-enterostomy was cut off and the gastrojejunal ulcer excised. The fistula was closed.

Convalescence was uneventful. The patient left the hospital on the fourteenth day and is now under our care.

Case VI (A306,138).—Dr. D. B., aged thirty-four years, came for examination February 12, 1920. A gastro-enterostomy had been performed elsewhere five years before for pyloric ulcer with obstruction. The patient's first complaint was diarrhea. Since his childhood he had had symptoms of duodenal ulcer, pain in the morning relieved by food, and vomiting at night or in the morning of the food which he had eaten the day before. Gastro-enterostomy had relieved him until sixteen weeks before examination. He had lost 18 pounds in weight. Occasionally he vomited fecal matter.

Roentgen-ray examination revealed a communication between the stomach and the transverse colon. Urinalysis was negative with the exception of a slight amount of albumin. The hemoglobin was 78 per cent., the leukocytes numbered 15,800. A test-meal showed a total acidity of 40 to 50, and free hydrochloric acid 20 to 30; clay-colored fecal matter was found in the contents.

At operation, February 24, 1920, a gastrocolic fistula and a duodenal ulcer were found. The opening between the gastro-enterostomy and the transverse colon admitted two fingers. The stomach was large. The fistulas were closed and a new gastro-enterostomy made.

The patient had an uneventful convalescence and was able to leave the hospital the twelfth day and to return home eleven days later. He reports that he is well.

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THE FORMATION OF A CLOACA IN THE TREATMENT OF EXSTROPHY OF THE BLADDER

CHARLES H. MAYO

In the early embryonic development of all mammals the rectum and the bladder, united with the generative ducts, are included in a single receptacle, the cloaca. The cloaca persists for urine and feces in most vertebrates below the Eutheria. Its persistence in man is one of the most distressing anomalies; in the endeavor to relieve the condition the surgeon naturally considers transforming the rectum into a cloaca.

From 1896 to October 1, 1921, 72 patients with exstrophy of the bladder have been observed in the Clinic. The anomaly is rare, occurring, according to various estimates, but once in from 30,000 to 50,000 births. In all cases the naturally associated anomalies, absence of the pubic arch and epispadias, are noted. Other defects, such as relaxation of the sphincter ani with prolapse of the rectum, are observed occasionally in young children, and still less frequently double ureter, the absence of one kidney, in the male undescended testicle, and in the female bifid uterus and double vagina (Figs. 514, 515).

Exstrophy of the bladder is a serious condition. Statistics show that approximately 50 per cent. of the children thus afflicted die by the tenth year. In infancy and early childhood cleanliness is more easily maintained than in young adult and later life. The difficulty of preventing odor usually socially ostracizes the afflicted persons, who often are very intelligent and highly sensitive. Unless operation is performed early most of them cannot attend school. The exposed surface of the bladder is constantly irritated by absorbent dressings. As a result of such irritation, cancer developed in the wall of the bladder in 2 patients under thirty who came to the Clinic; in 1 patient it was far advanced when discovered, and in the other it followed successful transplantation of the ureters and removal of the bladder (Case II). The malignancy was not recognized for a number of months after the operation.

The placenta of human beings and of various animals has flat platelets scattered throughout, with a tuft of capillaries beneath each, much like glomeruli in the kidney. In the embryonic transformation of the nephrogenic tissue into true kidney tissue this anatomic condition undoubtedly serves the purpose of delivering the urinary output from the child's blood to the mother's blood. The wolffian body or mesonephros is a gland of urinary excretion. In one group of mammalian embryos, includ-

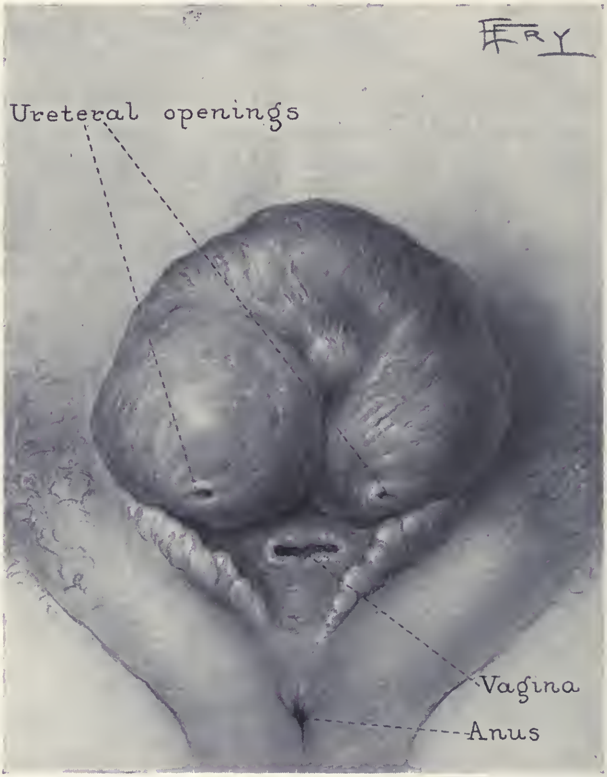

Fig. 514.—Exstrophy of the bladder in the female.

ing the pig, sheep, and cat, the wolffian body serves, as in birds and reptiles, until the true kidney can function. In a second group of mammalian embryos, including the rat, rabbit, guinea-pig, and man, there is a period after the wolffian body degenerates and before the kidneys reach functional ability in which urinary excretion is taken over by the placenta. The structural development enables the mother to eliminate toxins from the embryo by way of the urine. If the function of filtration fails before the bladder is fully prepared to receive urine, the bladder probably splits its anterior surface, including the urethra and the hypogastric canal to the umbilicus. This drags down the umbilicus and leaves it at the upper border of the bladder, which is everted by an increase of abdominal pressure. Of the 72 patients in the Clinic only 1 had a normal umbilicus. This patient had the defect of the pubic arch, a large open and uncontrolled outlet in the bladder, and no urethra (Fig. 516). The rupture had probably occurred later in intra-uterine life than the defect usually develops. The early distention of the bladder before union of the pubic bones prevents their union.

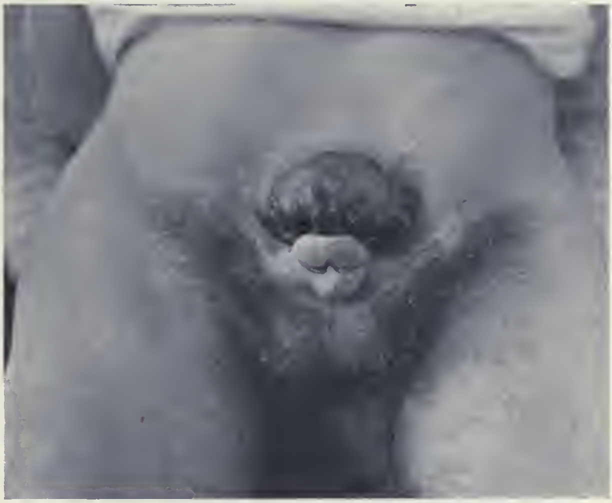

Fig. 515.—(Case 228,976.) Exstrophy of the bladder in the male.

Early surgical measures for the relief of this distressing condition were mainly directed toward covering in the exposed mucosa of the bladder by some plastic operation, and if this object was accomplished it was deemed satisfactory, although there was no prospect of controlling the bladder. The next step in the progress of treatment was the development of a cloaca by uniting the base of the bladder into the anterior wall of the rectum, known as Maydl's operation. Moynihan devised a method of using a large area of the wall of the bladder. A still later method was the separate anastomosis of the ureters to the large bowel. Various means also were devised for controlling the small newly developed bladder or the ureters by utilizing the anal sphincter and delivering in front of the anal opening. I have previously stated that because of a difference in the absorb-

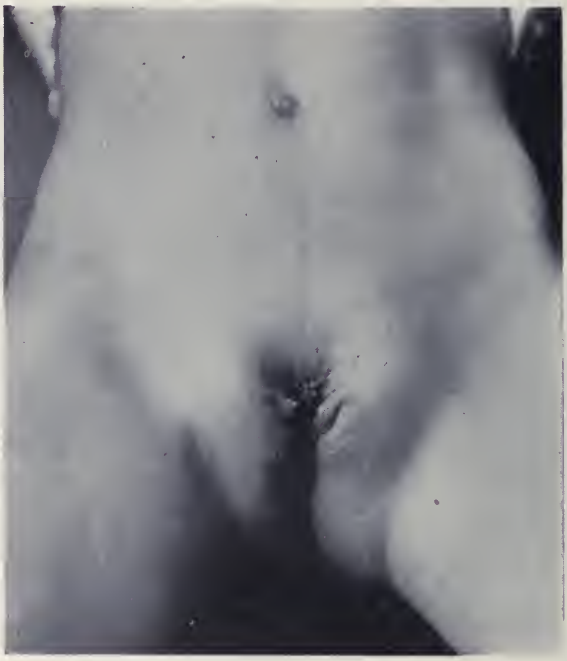

Fig. 516.—(Case 52,973.) The only patient in the Clinic in the series of 72 in which the umbilicus was present.

ing area a cloaca should be formed at the termination of the large bowel, and not at the cecum, as has been attempted. It should be noted, too, in producing uremic conditions in experimental work that urine must not only be eliminated by the kidneys but also it must be delivered from the body; the urine from one kidney delivered into the small intestine does not cause death if the urine from the other kidney is delivered externally, but death always occurs if the urine from both kidneys empties into the small intestine.

The dangers of forming a cloaca surgically are: (1) Peritonitis, since the operation in most instances is intraperitoneal, and (2) ascending infection of the kidney from the union with the intestine. The latter danger may be overcome largely by the Coffey method of transplantation, placing the ureter 2.5 cm. or more between the mucous membrane of the colon and its muscular and peritoneal coats. This incorporation of the ureter into the wall of the gut leads to compression and closure from tension within the bowel by feces, liquids, or gases, and is safer than folding the entire thickness of the bowel around the ureter to form a stiff channel, the so-called Russian or Peters method of union, which is similar to the Witzel method of enterostomy or gastrostomy. A moderate amount of pyelitis with slight fluctuation of temperature of 1 or 2 degrees often occurs for several days following each anastomosis. Naturally the cloaca can be developed only in persons who have a good sphincter ani. One of the late results in persons who survive to youth or adult life with exstrophy of the bladder is contraction of the ureteral outlets on the surface of the bladder, leading to cystic kidney and hydro-ureter on one or both sides. It is impossible to place large dilated ureters into the colon with any degree of safety, and the kidney is less prepared to resist infection. If it can be determined that a ureteral orifice is contracted, it can be dilated or incised, giving considerable time to allow for shrinking of the ureter before an effort at anastomosis is made. This may apply to one kidney only, and it involves some risk of pyelitis or nephritis.

The operation should be divided into three stages. If conditions seem favorable after exploration of the kidneys and ureters the right ureter is transplanted into the lower sigmoid; thus there is some urinary absorption for from seven to ten days,

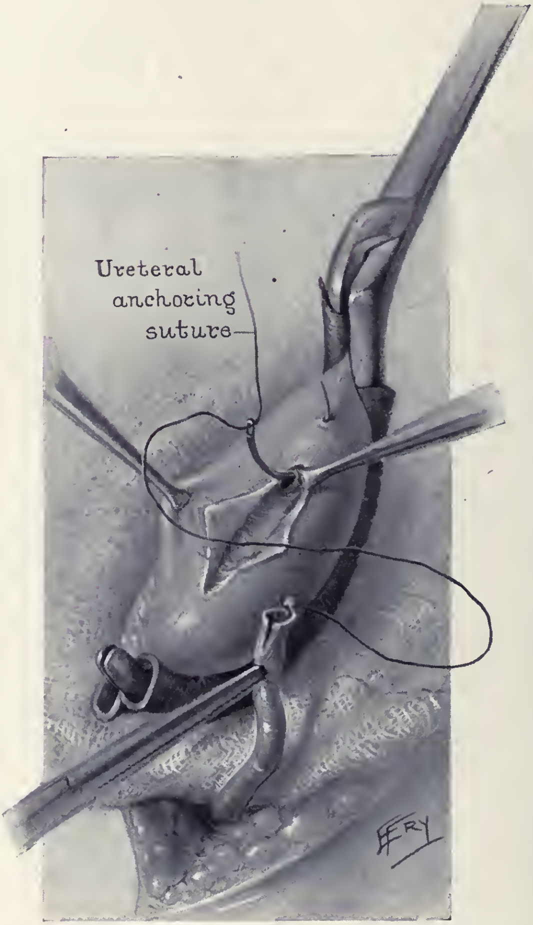

Fig. 517.—Mucous membrane exposed and opening made in mucosa to receive the ureter.

while the left kidney is delivering to the surface. The bowel's tolerance to urine is established by the first transplantation, and the remaining ureter can be transplanted with but little reaction from absorption. The third stage of the operation consists in the removal of the wall of the bladder, including the stumps of ureter, and closure of the opening with fascia (Figs. 517, 518).

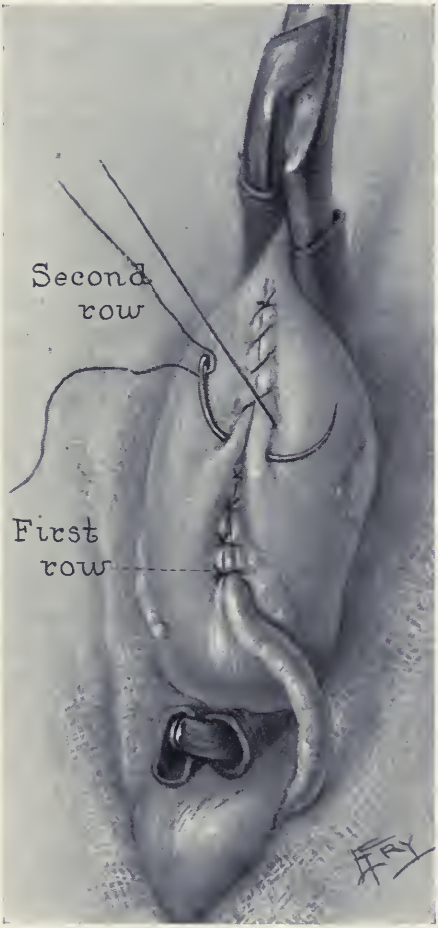

Fig. 518.—Entire area buried beneath the continuous approximating sutures in the serous coat.

Of the 72 patients, 6 who came during our early work were operated on by the plastic method to cover the exposed surface of the bladder and protect it from injury and irritation. A cloaca was formed by the Coffey method of transplanting the ureters in 36 patients, in 29 successfully. Two of these patients had but one kidney each, and one patient had a hydronephrosis and an atrophied kidney. Three patients were operated on by the Maydl-Moynihan method; 2 of them died of uremia. Twenty-seven patients were not operated on; most of them were too young, some were too old, or they had renal complications. One patient was fifty-two years of age; in his case Watson's nephrostomy might have been considered. A few of the children had not acquired complete control of the rectal sphincter and had varying degrees of prolapse, and consequently operation has been deferred until this control is gained. It is inadvisable to operate on children who are unable to attend to their clothing and the needs of nature. The best time for operation is between the ages of four or five and ten. Several of the patients not operated on were more than thirty-five years of age; they had contracted ureteral orifices, causing great dilation of the ureters and cystic kidneys.

The operative mortality is less than 20 per cent. This death-rate appears high, but when it is considered that these patients are relieved of a most distressing condition and that if left alone 75 per cent. of them would die before the age of thirty, the operation seems warranted.

ILLUSTRATIVE CASES

Case I (A93,590).—Miss M. D., aged thirty years, came to the Clinic October 11, 1913 because of complete exstrophy of the bladder. Both ureteral meati were visible and functioning. Only the lower portion of the labia was present. There was no umbilicus. Transplantation of the ureters by the Coffey method gave perfect relief. The patient has taken nurses' training since operation, and is now on active duty.

Case II (A190,148).—Miss L. W., aged twenty-three years, was examined April 3, 1917. The exstrophied bladder was small, red, and granulomatous, but not tender. The pubis symphysis was lacking. April 18th the right ureter was transplanted into the sigmoid just above the rectum. May 7th the left ureter was transplanted into the sigmoid. May 22d the bladder wall, which was thickened and indurated about the trigone, was removed, and the tissue beneath, which was markedly hyperplastic and thickened, was treated by Roentgen ray. At the end of a year the cloaca was functioning perfectly and the patient had control of urine for eight hours. In September, 1919 she returned with carcinoma in the scar tissue in the area from which the bladder had been removed. Radium treatment was given. May 5, 1921 the patient died from progressive carcinomatosis.

Case III (A259,298).—Miss E. B., aged twenty-one years, was examined November 5, 1919. She had reduplication of the uterus and vagina, a large hydronephrosis of the left kidney and hydro-ureter, and exstrophy of the bladder. The right kidney and ureter were normal. The right ureter was transplanted into the rectosigmoid by the Coffey method. The left kidney was greatly distended, cystic, totally blocked, and dilated to the size of the ilium. The left ureter was, therefore, not transplanted and the kidney not removed. This patient is getting along nicely with the one functioning kidney and the cloaca.

Case IV (A331,097).—J. S., a boy aged five years, was brought to the Clinic August 24, 1920 because of exstrophy of the bladder. He had rectal prolapse and poor control of the sphincter ani. Should sphincter control develop, re-examination and possible operation will be advisable.

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A HUGE DIVERTICULUM OF THE BLADDER

VERNE C. HUNT

CASE A321,653.—Mr. T. S. K., aged sixty-six years, came to the Clinic June 26, 1920 complaining of bladder trouble of four years' duration and characterized by slowness in starting the urinary stream and low abdominal pain, at times very severe. There was no frequency, and no gross blood or pus in the urine.

Examination revealed systolic blood-pressure 110 and diastolic 68; dental caries and sepsis; a large doughy mass filling the lower abdomen to the level of the umbilicus; apparently a huge distention of the urinary bladder, and a moderate-sized right inguinal hernia. A small prostate was palpated by rectum, which hardly seemed sufficient to account for the bladder distention; 1500 c.c. of residual urine were withdrawn by catheter. The specific gravity was 1.019. There were 48 mg. urea per 100 c.c. of blood, and 20 per cent. phenolsulphonephthalein output in two hours and fifteen minutes. The hemoglobin estimation was 70 per cent. A Wassermann reaction on the blood was negative.

Because of the huge distention of the bladder a cystoscopic examination or cystogram was not made, but diverticulum of the bladder was supected and suprapubic drainage recommended. This was done without exploring the bladder. Three weeks later the phenolsulphonephthalein output had increased to 45 per cent. in two hours and fifteen minutes, and the patient's general condition was good.

Cystoscopic examination at this time disclosed median bar enlargement of the prostate and great deformity of the right wall of the bladder from extravesical pressure, and, although a diverticulum was suspected, its opening could not be seen.

September 3, 1920 the suprapubic sinus of the drainage operation was enlarged, and it was found that the suprapubic drainage-tube had been placed in a diverticulum several times the size of the bladder, with a capacity of at least 1000 c.c. The diverticulum originated from the right wall of the bladder in the neighborhood of the right ureteral orifice; it was firmly fixed to the lateral and posterior pelvic walls and was removed only after the peritoneum had been opened. The right ureter was so closely incorporated in the diverticulum that it was cut and doubly ligated with silk at the pelvic brim, and dropped back rather than transplanted into a new segment of the bladder; thus the left kidney was relied on entirely for future function. The prostate seemed of little significance and was not removed. The peritoneum was accurately closed, as was the bladder. A urethral catheter was inserted and a tube was placed in the extravesical space for drainage.

Severe reaction followed the operation. There was only 525 c.c. urine output the first twenty-four hours, and at the end of forty-eight hours but 1700 c.c. of urine had been passed. The abdomen was greatly distended, the pulse was 150, and the patient's general condition was very poor, all of which was explained on the basis of peritonitis and renal insufficiency. Under local anesthesia the abdomen was opened and tube drains were inserted for a low-grade peritonitis, and the distended pelvis of the right kidney, whose ureter had been ligated, was drained through the back. The patient's condition improved immediately and recovery was complete. The catheter was left in the pelvis of the right kidney for three weeks, at which time there was a return of 15 per cent. of phenolsulphonephthalein from the right kidney and 25 per cent. through the bladder from the left kidney in two hours and fifteen minutes. On removal of the catheter from the pelvis of the right kidney the urinary drainage from the kidney immediately ceased. Apparently atrophy of the right kidney occurred; this obviated subsequent nephrectomy, since all wounds healed. Cystoscopic examination six weeks after the operation showed urine entering the bladder only from the left kidney.

DISCUSSION

The diagnosis of diverticulum, its size, a capacity of 1000 c.c., one of the largest, if not the largest, observed in the Clinic, and the effect of ligation of the ureter make this case of general interest.

The diagnosis of surgical lesions of the genito-urinary tract by cystoscopic examination and its allied methods in skilful hands approaches an exact science. It is due to accuracy of diagnosis that more diverticula of the bladder are now found than formerly. In 1918 Judd reported 44 cases in which operation had been performed in the preceding ten years. He emphasized the importance of exploring the bladder at the time of performing a prostatectomy in patients with marked cystitis and infection. Often diverticula are found when the bladder contains foul urine.

The diagnosis in this case was not established until operation. A cystogram was recommended before operation, but not made; this method often demonstrates a diverticulum when cystoscopic examination fails to reveal the opening.

The disposal of the ureter in the excision of diverticula which include the ureter and in resections of the bladder for malignancy is not always easy to decide. A differential functional determination can usually not be made in these cases; however, with a good combined function and finding at operation a dilated thick-walled ureter, on the side of involvement, it is comparatively fair to assume that the ureter is partially, if not completely, obstructed, and that the opposite kidney is carrying on adequate function. In these cases probably little is to be gained by transplanting the ureter, and usually it can be tied off and dropped back with safety. When this has been done, in the absence of infection in the corresponding kidney, we have experienced no trouble, and a subsequent nephrectomy has not been necessary. However, if a normal ureter is encountered which has not been obstructed, or if the function of the opposite kidney is in doubt, it is advisable to transplant the ureter into a new segment of the bladder; or it may be possible to sacrifice only the vesical portion of the ureter with establishment of its lumen, as has been described by Lower. If a ureter is tied and symptoms of renal insufficiency occur postoperatively, the pelvis of the kidney may be opened to re-establish its function and the ureter transplanted later if necessary.

In this case drainage of the pelvis of the kidney on the side of ligation carried the patient through until the single kidney was able to take over the entire load. It is of interest that a urinary fistula did not persist and require nephrectomy.

ADENOMYOMA PRESENTING AS A TUMOR OF THE BLADDER

E. Starr Judd

THE patient, a single woman aged thirty-four years, whose occupation is housework and clerking in a store, was referred to me by Dr. Priestley of Des Moines, Iowa. The patient complained chiefly of constant pain in the lower abdomen. The patient's father and mother are living and well, and there is no history in the family of malignancy or tuberculosis. Four years ago a pelvic tumor and her appendix were removed. She began to menstruate at the age of fourteen years and menstruated regularly until two years ago, when a hysterectomy was performed. For four or five years she has had frequent and painful micturition, with straining and increased pain at the close of voiding. Formerly the pain was more severe during menstrual periods. She had backache, but no actual pain in the back, and intense pain in both sides, low down and throughout the pelvis. The pain had been more severe for about two weeks of each month. It radiated down the right leg and around the hip. She had obtained no relief from applications of heat, and had been obliged to take aspirin and other drugs prescribed by her home physician in order to endure the pain.

The patient was found to be nervous and thin, weighing 80 pounds. Her normal weight is about 105 pounds. Impaired resonance was noted at both apices, but without signs of activity. All of the uterus, except the cervix, had been removed. A mass not freely movable, tender to bimanual pressure, could be felt in the pelvis around the right fornix. Pain similar to that in the groin and leg could be brought on by pressure on this mass. The specific gravity of a twenty-four-hour specimen of urine was 1.021; it was alkaline in reaction, and contained a small amount of albumin and a few pus-cells. The hemoglobin was

75 per cent., the erythrocyte count was 4,500,000, and the leukocyte count 9800. The systolic and diastolic blood-pressures were normal. Roentgenograms of the kidneys, ureters, and bladder did not reveal evidence of disease. The cystoscopic examination revealed a tumor of the bladder, about 4 cm. in diameter and involving the right side of the trigone, the right ureteral meatus, and a part of the right wall of the bladder. It extended practically to the urethral orifice. Dr. Braasch stated that the induration in the trigone extended across to the left meatus, but apparently did not interfere with it. The tumor seemed to be entirely covered with normal mucous membrane. There was no area of ulceration or necrosis and no evidence of papillary growths. A piece of the tumor was removed for microscopic study during the cystoscopic examination, but no evidence of a neoplasm was obtained, and the condition was reported to be inflammatory. A diagnosis of tumor of the bladder was made by Dr. Braasch, in spite of the fact that the usual history of hematuria which occurs in nearly all neoplasms of the bladder was not present. He stated in his report that the tumor was evidently secondary to a tumor of the right pelvis extending across the culdesac. Because of the patient's increasing suffering it seemed best to operate with the hope of removing the growth, even though there was considerable uncertainty about being able to do so.

November 19, 1919 I opened the abdomen in an endeavor to determine the nature and extent of the involvement. A fair-sized low midline incision was made and the intestines were packed away from the pelvis after the surface of the liver had been palpated to be sure that it did not contain metastatic nodules. This exposure revealed a diffuse, infiltrating tumor in the right side of the pelvis, involving the wall of the bladder and extending into the large muscles just inside the bony pelvis. The right ovary contained a cyst, and with the tube was attached firmly to the neoplasm. The tumor was more prominent within the bladder, the mucous membrane of which was intact. The right ureter was dilated above the growth and disappeared into it. The left ureter came close to the growth, but whether or not it was involved could not be determined. While it appeared that considerable dissection would be required in order to remove the growth, it was nevertheless evident that removal could be accomplished with a fair prospect for future relief, provided the growth was not malignant. Removal of the tumor would necessitate the resection of so much of the lower end of the right ureter that reimplantation into the bladder would be impossible. Experience has taught me that it is best to ligate the cut-off ureter with permanent ligature and, should it become necessary, to remove the involved kidney. This seems a better plan than to transplant the ureter into the colon or to remove the kidney at this time. In the case presented the right ureter had probably been closed for some time and as a result the kidney had ceased to function. The cystoscopic examination showed that the growth was involving the ureter and no urine was coming down from the right side. I have not known serious trouble to result from ligating the ureter at time of resecting the bladder for neoplasms if it had been determined that the ureter and kidney on the opposite side were normal. Undoubtedly in many extensive pelvic operations in the past the ureter has been ligated, and has not produced sufficient symptoms to cause it to become known.

With the tumor I removed the lower 10 cm. of the right ureter, about one-half of the right wall of the bladder, and a part of the trigone, carrying the resection down to the ureteral orifice. I was careful to preserve all the sphincter muscle at this point. It was also necessary to remove the right ovary because of its attachment to the tumor, and some of the muscles on the side of the pelvis. Even if I had been certain at this time that the condition was not malignant I do not believe that it would have been possible to remove the tumor and save any of the structures.

The sigmoid was attached to the tumor, and in separating it a small opening was made; this was readily repaired. The bladder was reconstructed and closed completely. Drainage was established by retention catheter through the urethra. Two small Penrose drains were placed in the abdominal wound.

The reaction following the operation was not more than might be expected. The pulse-rate reached 120 the first night, then gradually decreased, and in a few days was normal and remained so. There was a serous discharge from the wound and after a number of days urine began to escape. The retention catheter was replaced and drainage ceased. The wound in the bladder closed and remained healed. At the end of six weeks the patient was dismissed from the hospital; her wound was entirely healed, and she was voiding normally, although frequently. A recent report states that her frequency has subsided entirely and her bladder functions normally. She is perfectly well and is working.

DISCUSSION

This case presents many problems. It was necessary to ligate the right ureter in order to remove the tumor, and yet two years have elapsed since the operation, with no signs of trouble from completely closing off the kidney. Another interesting feature is that the patient had a normally functioning

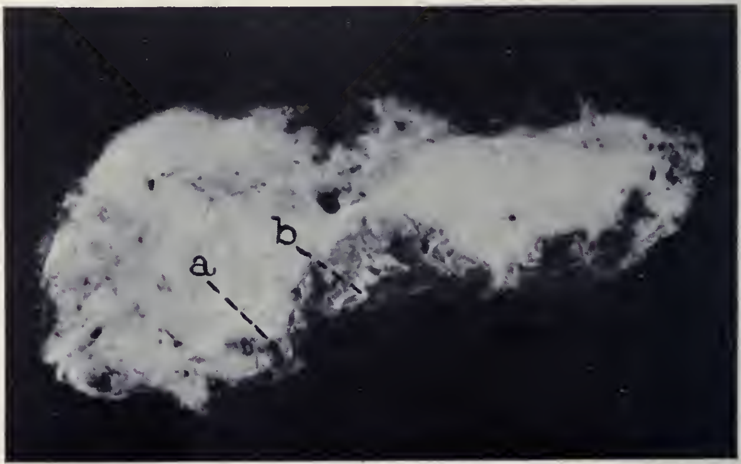

Fig. 519.—(Case 296,495.) Cross-section of adenomyoma of the bladder: *a*, Small cystic areas filled with dark brown pigment in close proximity to (*b*) epithelium of the bladder.

bladder in a comparatively short time, even though it was necessary to remove considerable of the wall including a part of the trigone.

Figures 519–524 show the nature of the neoplasm. The tumor, an adenomyoma in the wall of the bladder, was about 8 cm. in diameter; a smaller growth, apparently a separate adenomyoma, was in the fallopian tube. It was impossible to determine the exact point of origin of this tumor, as the patient had had two pelvic operations elsewhere and the uterus had been removed. Whether the tumor had any connection with the uterus or whether it was of the nature of those arising in the rectovaginal septum could not be determined. Evidently it is completely eradicated, since the patient has now been free from symptoms for two years.

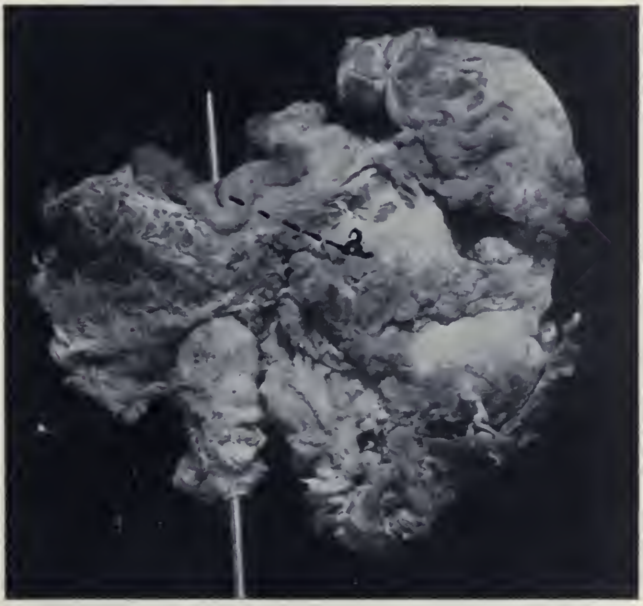

Fig. 520.—(Case 296,495.) Probe inserted into the right ureter through the meatus, both surrounded by tumor tissue. Note epithelium of the bladder at *a*.

The controversy as to whether these tumors originate from

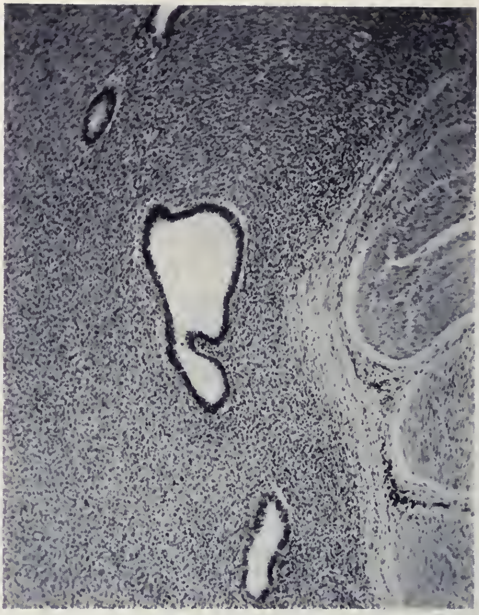

Fig. 521.—Section through the adenomyoma. Typical endometrium between bundles of smooth muscle of the wall of the bladder (× 50).

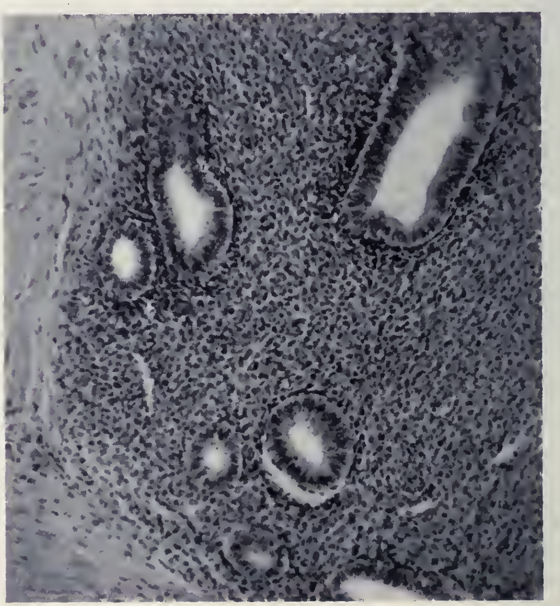

Fig. 522.—Higher magnification of section shown in Fig. 521 (× 100).

structures coming from the wolffian duct or from those coming from the müllerian duct is not settled to the satisfaction of all. Cullen says that the mucous membrane cells in adenomas are always connected with the mucous membrane of the uterine cavity. Adenomyomas occurring in the round ligament or elsewhere have all the characteristics of those in the uterus.

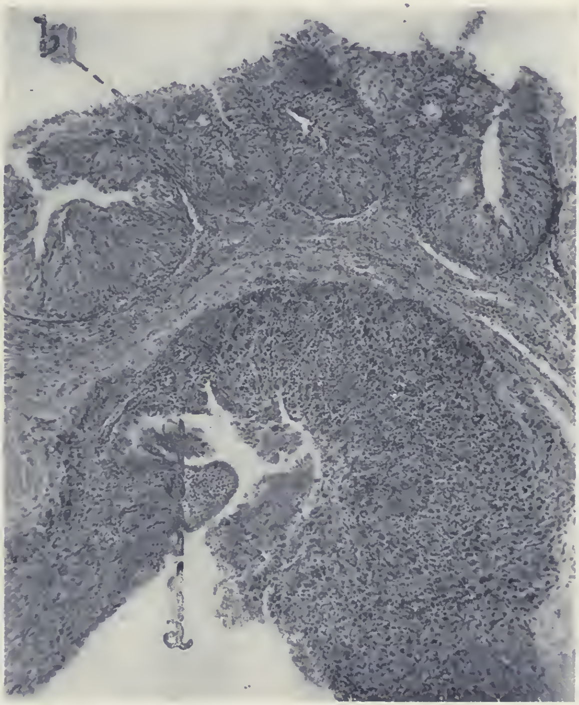

Fig. 523.—Section through adenomyoma of the bladder, illustrating relation of (*a*) adenomatous tissue to (*b*) bladder epithelium.

Some observers contend that in the embryo a portion of the wolffian duct is nipped off and is the origin of the adenomyoma; others contend that the tumors arise from the müllerian duct, since the mucosa lining them is in every way like the mucosa lining the uterus, and further, that during menses this mucosa also becomes active, so that after menses the adenomyomas of the round ligaments and elsewhere contain blood. Cullen in

1911 reported 9 cases of tumor of the umbilicus that proved to be adenomyomas. He says that undoubtedly 4 of these originated from Müller's duct, which gives rise to the uterine mucosa. Adenomyomas in the rectovaginal septum, he says, must originate from Müller's duct. In the case reported here the adenomyoma occurred in the bladder, and it is possible that the tumor which I removed was recurring or that a part of the tumor had been removed, and that I removed the extension from it. This growth was much more apparent in the inside of the bladder than it was elsewhere, but the extravesical portion might have been removed previously. This is the only case of the kind we have seen in operating on a large number of cases of tumor of the bladder.

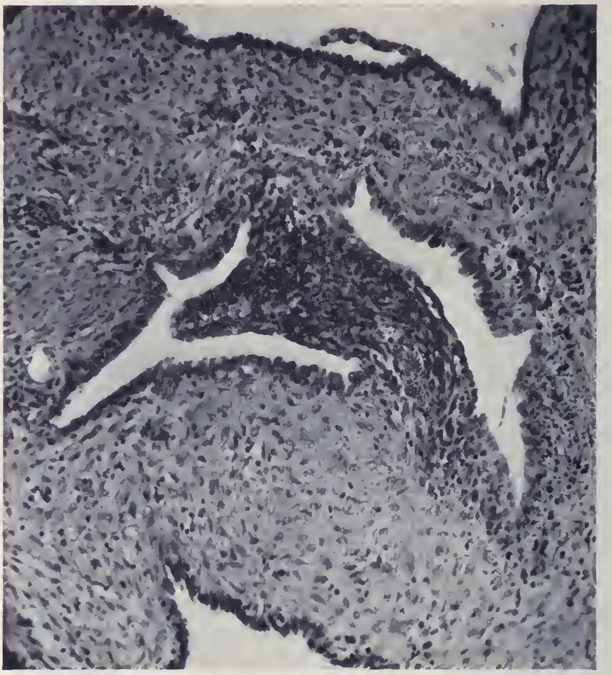

Fig. 524.—Adenomyoma of the right tube; the glandular tissue is surrounded by smooth muscle of the tube.

PROGNOSIS IN CASES OF CARCINOMA OF THE PROSTATE DISCOVERED AT OPERATION

E. Starr Judd, Hermon C. Bumpus, Jr., and Albert J. Scholl, Jr.

With the advent of radium as a therapeutic agent in the treatment of carcinoma of the prostate the surgical removal of the gland was generally abandoned. However, careful microscopic examination of prostates, removed presumably because of benign hypertrophy, occasionally reveals areas of malignancy. Malignant areas are more easily discovered in fresh specimens, since the tissues pucker and draw, producing a stellate point. Such areas are usually found in the posterior lobe, but occasionally they are discovered in the lateral lobes also; they are generally very small.

Carcinoma of the prostate discovered at operation is one of three types that are treated surgically: (1) The carcinomatous changes which although undoubted are deemed sufficiently early to warrant an attempt at surgical removal, (2) suspected carcinomas in which a positive diagnosis is not possible, and (3) the type discovered at operation. It would naturally be supposed that the prognosis in the last type would be the best, and in the first type the poorest. In an endeavor to confirm this point we made the investigation herewith reported.

Many of the patients studied were very old and had lived their natural lives, but they were suffering so much from their prostatic trouble that it seemed only right to attempt to relieve them, even with the possibility that they would not live very long. Many of them had infections that had extended into the kidneys, and while such conditions might be relieved by the operation, the risk was increased and the probability of many years of life was diminished. The greater number of these patients who lived two years or less following operation died from cardiovascular and cardiorenal diseases which are common in men of this age. In spite of this one must feel that the patients were well repaid for the operation on the prostatic neoplasm by the great relief from their bladder symptoms. While the lives of these patients were prolonged for a considerable length of time, the patients did not live long enough to fall into the group cured of cancer for three years.

In making a prognosis in cases of carcinoma of the prostate it must be borne in mind that many symptomless patients have been kept under observation for years while the malignancy was making slow progress. In several instances we have known carcinomas of the prostate, clinically diagnosed, to exist for from seven to ten years, with very little evidence of the progress of the disease.

Radical operations which include the removal of the sphincter controlling the stream of urine have not been satisfactory in our experience. We believe it is necessary to preserve the sphincter control of the urine, and as the disease nearly always involves the tissues of the posterior lobe it is practically impossible completely to remove it without destroying this function. For this reason particularly we hoped that radium would accomplish in these cases what it has, for instance, in cases of carcinoma of the cervix. At first this seemed probable, but a later review of results was disappointing, and we now believe it will be best to resume the operation of partial prostatectomy, thus removing all the part except that which involves the controlling mechanism, and then possibly applying radium to this portion.

In order to determine whether or not the form of operation had any bearing on the final results, the patients were grouped according to whether the operation was suprapubic or perineal. Seventy-five patients were operated on by the suprapubic route, and 11 (14 per cent.) lived more than three years following operation. Forty-two patients were operated on by the perineal route, and 5 (12 per cent.) have survived more than three years. Three years is not used arbitrarily as a unit of measure, but because in studying a series of 231 untreated patients thirty-four and fifty-nine-hundredths months was found to be the average duration of the disease, and obviously, with any form of surgical or radium treatment, a considerable portion of the patients treated must live longer than three years to make the treatment of value.

STATISTICAL DATA

Sixty-six of the 77 patients in whom cancer was either diagnosed or suspected prior to operation have been traced. Of these, only 8 (12 per cent.) have lived more than three years, a result that indicates that if carcinoma of the prostate has progressed sufficiently to be recognized clinically surgery offers no more favorable result than radium.

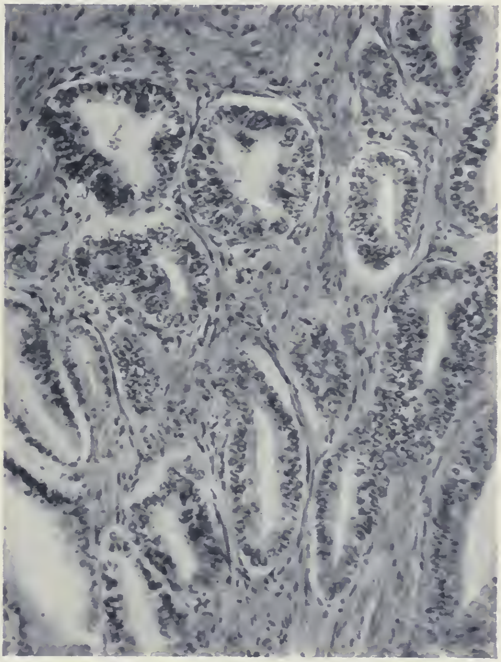

Fig. 525.—(Case 237,975.) Type 1 glandular carcinoma of the prostate (× 100).

Of still greater interest are the data obtained from the group of 62 patients in whom the malignancy was so obscure as to escape clinical detection, and was discovered only at operation or after careful examination of the gland microscopically. We have completed records of 51 of these patients, 8 of whom (15 per cent.) lived more than three years. Many of these patients have died from disease other than the prostatic carcinoma, but even so, this percentage of three-year cures is low if the early stage at which the growth was removed is considered. It affords adequate testimony of the seriousness of the findings of cancer cells in an excised gland, and does not permit the assumption that because the growth was apparently small it has been removed completely.

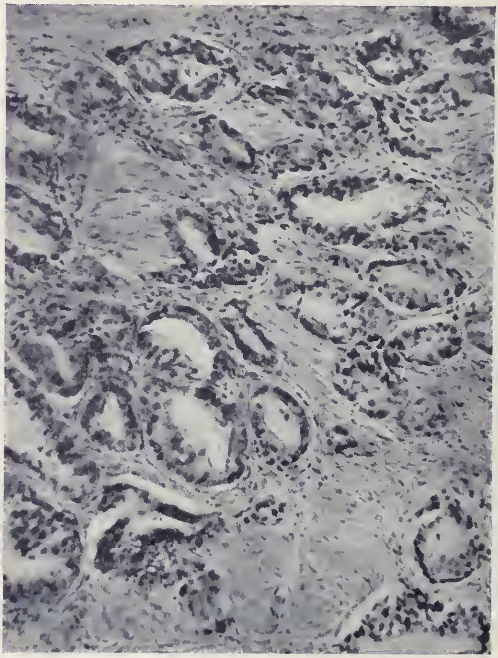

Fig. 526.—(Case 158,433.) Type 1 glandular carcinoma of the prostate with moderate fibrosis (× 100).

From the foregoing it is apparent that neither the type of operation nor the extent of the growth influences the prognosis in this class of patients. However, when the cases are grouped according to the pathologic findings a marked difference in results is noted, and we believe that the greatest factor in determining the prognosis of an individual case will not be the extent of the growth or the type of operation, but rather the type of the growth removed.

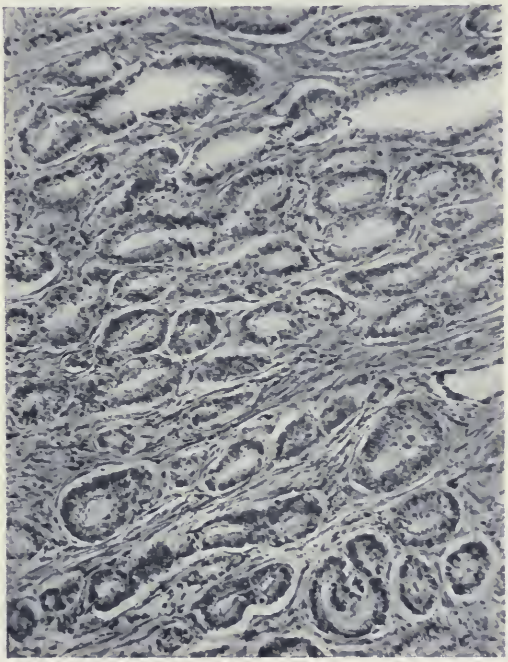

Fig. 527.—(Case 178,863.) Type 1 carcinoma of the prostate with extensive gland formation (× 100).

Pathologically and clinically there are two types of prostatic cancers, with, of course, intermediate stages. The first is the more common type, and its degree of malignancy is lower than that of the second type. The structure is made up of cells and glands and retains the normal or glandular structure (Figs. 525, 526). The cells are partly differentiated, fairly regular in size and shape, and retain the long tufted end projecting into the glandular lumen, which is the most significant feature of prostatic epithelium. The nuclei are round, relatively larger than the nucleoli found in normal or hypertrophied glands, and contain the distinct nucleoli which are so prominent in undifferentiated cells (Figs. 527–529). Clinically these prostates are large, nodular, stony, and produce the symptoms of obstruction first calling attention to their presence. The second type of cancer is often confused with lymphocytic infiltration. The malignant cells that have migrated into the stoma often show a streaked or etched-out appearance, in contrast to the clumped localized disposition of lymphocytic infiltration. The cells in such glands, either from morphologic or mechanical influences,

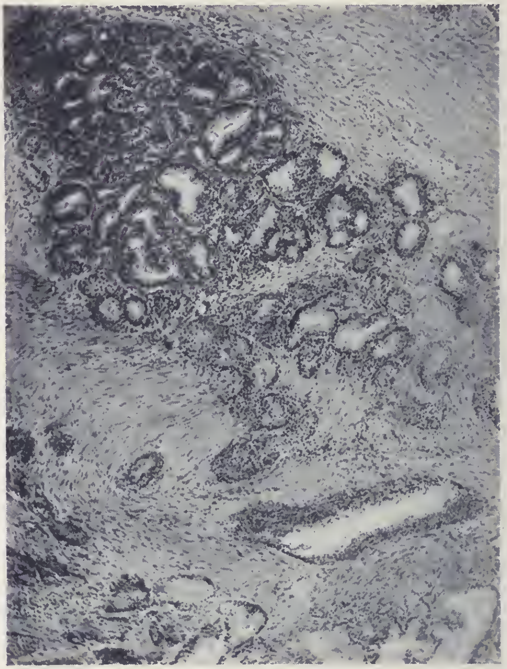

Fig. 528.—(Case 314,301.) Isolated area of small compact glands limited to the left lateral lobe of the prostate (× 50).

have lost their original structure; they do not conform to the usual type, but vary in size and arrangement. These may comprise great masses or extending wedges of tightly packed cells containing large deeply staining nuclei. In other cases the cells may be loosely arranged, separated, and supported by a small amount of connective tissue. In prostatic carcinomas of Type 2, in which there is an excess of fibrous tissue, the cells may have disappeared completely or may be pressed into bizarre lines and streaks (Figs. 530, 531). Often they are recognized only on account of the deeply staining nuclear fragments which persist. If there is glandular formation the acini are atypical and the cells are flat, grouped together irregularly, and contain nuclei which are relatively much larger than those found in non-

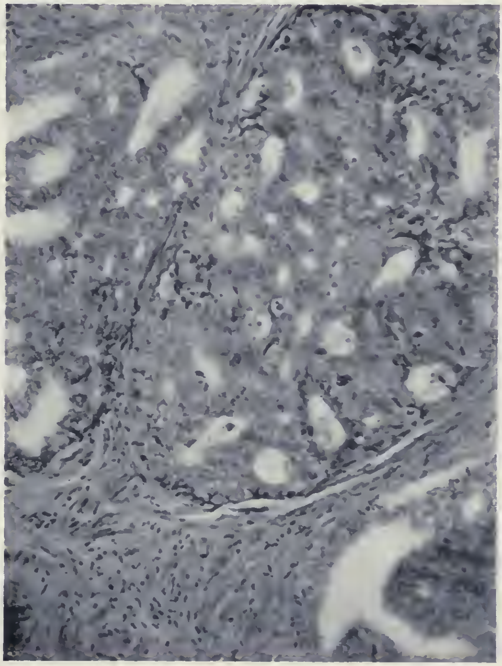

Fig. 529.—(Case 38,264.) Type 1 carcinoma of the prostate, showing usual method of extension along the collecting tubules (× 100).

malignant cells. Clinically the prostates of this type are small, fibrous, and firmly fixed. They are extremely malignant, metastasize readily, and are often unrecognized, since paralysis may occur as a result of the metastasis before the glands have reached sufficient size to produce urinary symptoms. Their small size often leads to the erroneous opinion that the patients are good surgical risks and to operations with unfavorable results.

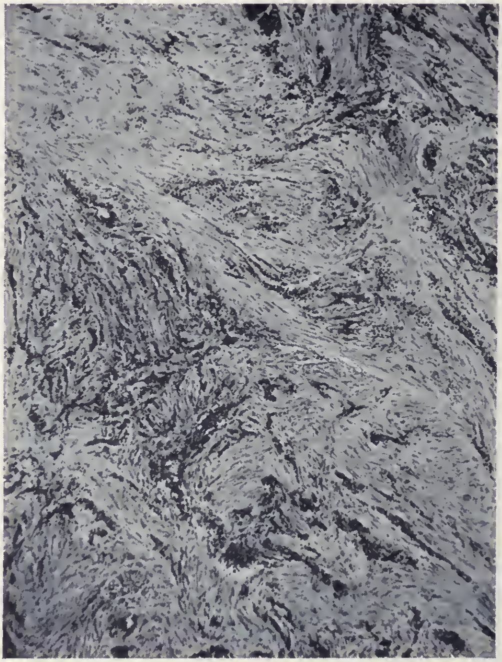

Fig. 530.—(Case 31,568.) Type 2 carcinoma of the prostate. Marked fibrosis. Deeply stained malignant cells scattered through stroma with practically no gland formation (× 50).

Of the 146 patients of our series, in 100 it was possible to correlate the histologic findings with the postoperative course (Tables 1 and 2). Forty-four prostates were of Type 1, and 56 were of Type 2.

Eleven patients with prostatic cancers of Type 1 lived more than three years. Twenty-two are still alive, 1 six years, 2 five years, 4 four years, 3 three years, 6 two years, and 6 one year. Sixteen of the patients with prostatic cancers of Type 2 lived two years, 7 lived three years, and only 1 lived more than three years. Three patients are still alive, 1 three years and 2 one year after operation.

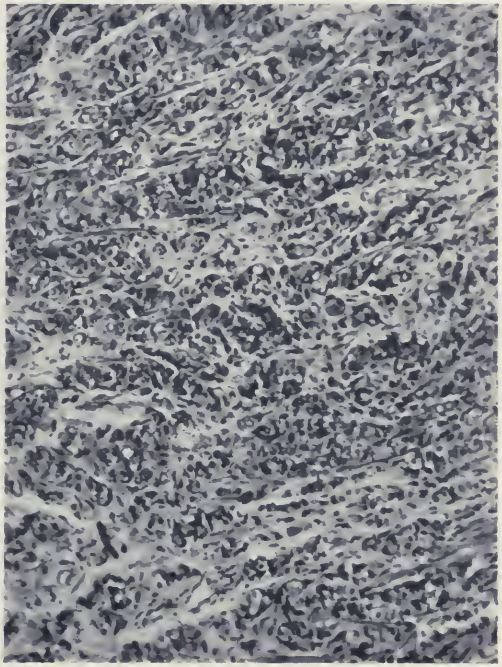

Fig. 531.—(Case 20,348.) Type 2 carcinoma of the prostate with an almost solid mass of malignant cells and small amount of fibrous tissue (× 100).

It seems evident, therefore, that in cases of cancer of the prostate the degree of malignancy, as demonstrated microscopically, determines the prognosis, and that when the disease has advanced sufficiently to be recognized clinically the possibility of surgical cure is diminished.

Table 1

146 PATIENTS OPERATED ON

	Patients.	Per cent.	Average age, years.	Average length of disease, months.	Perineal prostatectomy.	Suprapubic prostatectomy.	Average length of life after operation, months.
Traced	120	82.2	64.27	62.36	42	75 (3 not stated)	24.86
Dead	96	80.0	64.95	51.3	41	52	21.72
Living	24	20.0	63.58	80.2	1	23	35.2
			96 Patients Dead				
Lived from							
1 to 12 months	41	34.16	65.8	40.4	19	22	6.18
13 to 24 months	23	19.16	63.13	45.95	8	15	18.86
25 to 36 months	14	11.66	65.07	56.64	8	6	38.14
37 to 48 months	1	0.83	62.0	168.0	1	0	41.0
49 to 60 months	3	2.5	65.0	77.33	1	2	53.3
61 to 72 months	2	1.66	60.5	95.5	1	1	70.0
85 to 96 months	1	0.83	64.0	168.0	1	0	96.0
97 to 108 months	2	1.66	72.0	156.0	0	2	103.5
Not stated	9	7.5			2	4 (3 not stated)	
			24 Patients Living				
Living from							
1 to 12 months	4	3.33	64.75	66.75	0	4	10.2
13 to 24 months	8	6.66	66.25	67.85	0	8	19.87
25 to 36 months	5	4.16	61.4	71.0	0	5	31.8
37 to 48 months	1	0.83	69.0	87.0	0	1	48.0
49 to 60 months	2	1.66	53.5	83.0	0	2	52.5
61 to 72 months	2	1.66	59.0	83.0	0	2	67.5
73 to 84 months	1	0.83	75.0	139.0	0	1	78.0
109 to 120 months	1	0.83	61.0	174.0	1	0	120.0

Table 2

DIAGNOSIS BEFORE OPERATION IN 77 CASES

	Patients.	Per cent.	Average age, years.	Average length of disease, months.	Perineal prostatectomy.	Suprapubic prostatectomy.	Average length of life after operation, months.
Traced	66	85.7	64.73	50.37	22	44	24.58
Dead	60	90.9	64.71	48.79	22	38	23.26
Living	6	9.09	64.5	64.33	0	6	35.33
			60 Patients Dead				
Lived from							
1 to 12 months	24	36.36	64.0	35.7	11	13	6.05
13 to 24 months	16	24.24	64.0	49.62	5	11	19.68
25 to 36 months	8	12.12	67.37	53.62	3	5	31.5
49 to 60 months	2	3.03	66.5	79.5	0	2	55.5
61 to 72 months	2	3.03	60.5	95.5	1	1	70.0
96 to 108 months	2	3.03	72.0	156.0	0	2	103.5
Not stated	6	9.09			2	4	
			6 Patients Living				
Living from							
1 to 12 months	1	1.51	68.0	29.0	0	1	12.0
13 to 24 months	3	4.54	67.0	63.6	0	3	21.6
61 to 72 months	2	3.03	59.0	83.0	0	2	67.5

Table 3

62 CASES DISCOVERED AT OPERATION

	Patients.	Per cent.	Average age, years.	Average length of disease, months.	Perineal prostatectomy.	Suprapubic prostatectomy.	Average length of life after operation, months.
Traced	51	82.2	64.52	65.06	20	31	25.18
Dead	33	64.7	65.21	55.46	19	14	19.2
Living	18	35.2	63.27	87.0	1	17	35.16
33 Patients Dead							
Lived from							
1 to 12 months	17	33.3	68.47	46.17	8	9	6.35
13 to 24 months	7	13.72	61.14	36.16	3	4	17.0
25 to 36 months	6	11.76	62.0	60.66	5	1	30.33
37 to 48 months	1	1.96	62.0	168.0	1	0	41.0
49 to 60 months	1	1.96	62.0	73.0	1	0	49.0
85 to 96 months	1	1.96	64.0	168.0	1	0	96.0
18 Patients Living							
Living from							
1 to 12 months	3	5.88	63.66	79.3	0	3	9.6
13 to 24 months	5	9.8	65.8	71.0	0	5	18.8
25 to 36 months	5	9.8	61.4	71.0	0	5	31.8
37 to 48 months	1	1.96	69.0	87.0	0	1	48.0
49 to 60 months	2	3.9	53.5	83.0	0	2	52.5
73 to 84 months	1	1.96	75.0	139.0	0	1	78.0
109 to 120 months	1	1.96	61.0	174.0	1	0	120.0

Table 4

42 PERINEAL PROSTATECTOMIES[1]

	Patients.	Per cent.	Average age, years.	Average length of disease, months.	Average length of life after operation, months.
Traced	42	35.0	63.97	56.47	23.16
Dead	41	97.6	64.1	53.29	20.4
Living	1	2.3	61.0	174.0	120.0
41 Patients Dead					
Lived from					
1 to 12 months	19	45.23	65.5	45.4	5.7
13 to 24 months	8	19.04	64.37	37.2	17.6
25 to 36 months	8	19.04	60.75	60.12	29.1
37 to 48 months	1	2.38	62.0	168.0	41.0
49 to 60 months	1	2.38	62.0	73.0	49.0
61 to 72 months	1	2.38	64.0	117.0	68.0
85 to 96 months	1	2.38	64.0	168.0	96.0
Not stated	2	4.76			
1 Patient Living					
Living from					
108 to 120 months	1	2.38	61.0	174.0	120.0

[1] The type of operation performed on 3 patients was not recorded.

Table 5

75 SUPRAPUBIC PROSTATECTOMIES[1]

	Patients.	Per cent.	Average age, years.	Average length of disease, months.	Average length of life after operation, months.
Traced	75	62.5	64.87	58.24	24.76
Dead	52	69.33	65.43	48.08	22.75
Living	23	30.66	63.69	82.84	31.52

52 Patients Dead

Lived from					
1 to 12 months	22	29.33	65.68	36.27	6.5
13 to 24 months	15	20.0	62.46	50.92	19.53
25 to 36 months	6	8.0	70.83	52.0	33.5
49 to 60 months	2	2.66	66.5	79.5	55.5
61 to 72 months	1	1.33	57.0	74.0	72.0
97 to 108 months	2	2.66	72.0	156.0	103.5
Not stated	4	5.33			

23 Patients Living

Living from					
1 to 12 months	4	5.33	64.75	66.75	10.25
13 to 24 months	8	10.66	66.25	88.42	19.87
25 to 36 months	5	6.66	61.4	71.0	31.8
37 to 48 months	1	1.33	69.0	87.0	48.0
49 to 60 months	2	2.66	53.5	83.0	52.5
61 to 72 months	2	2.66	59.0	83.0	67.5
72 to 84 months	1	1.33	75.0	139.0	78.0

Table 6

PATHOLOGIC CONDITION AND POSTOPERATIVE RESULTS IN 100 CASES

(44 cases of Type 1, 56 cases of Type 2)

65 Patients Dead

Type 1 prostatic cancer	22 (50.0 per cent. of 44)
Type 2 prostatic cancer	53 (94.6 per cent. of 56)

Lived from	Type 1.	Per cent.	Type 2.	Per cent.
1 to 12 months	4	9.9	30	53.6
13 to 24 months	3	6.8	16	28.5
25 to 36 months	6	13.4	7	12.5
37 to 48 months	7	15.7	0	0
49 to 60 months	1	2.1	0	0
61 to 72 months	1	2.1	0	0
	22	50.0	53	94.6

35 Patients Living

Type 1 prostatic cancer	22 (50.0 per cent. of 44)
Type 2 prostatic cancer	3 (7.2 per cent. of 56)

Living from	Type 1.	Per cent.	Type 2.	Per cent.
1 to 12 months	6	13.6	2	3.6
13 to 24 months	6	13.6	0	.0
25 to 36 months	3	6.8	1	1.8
37 to 48 months	4	9.9	0	0
49 to 60 months	2	4.2	0	0
61 to 72 months	1	2.1	0	0
	22	50.0	3	5.4

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[1] The type of operation performed on 3 patients was not recorded.

ILLUSTRATIVE CASES OF MALIGNANT TUMORS OF THE THYROID

Louis B. Wilson

There is a wide-spread belief that malignant tumors of the thyroid are of rare occurrence, when, in all probability, they are actually of relatively frequent occurrence. Another erroneous impression is that they develop only in middle life and progress rapidly to a fatal termination, when, in reality, many of them apparently start as adenomas in the third decade and progress very slowly. There is probably a higher percentage of error in the early diagnosis of malignant tumors of the thyroid than in the diagnosis of malignant tumors of any other organ of the body. This is partly due to the resemblance, in early cases, of malignant processes in the gland to other conditions. It is also due to failure to follow up cases for sufficient periods of time to determine the final outcome and thus to check diagnoses. Owing, in large measure, to the numerous errors in diagnosis and to the frequent failure of surgical treatment, there is an unfortunate lack of literature in English concerning malignant tumors of the thyroid which the subject would warrant.

I desire to present herewith a few cases illustrating some of the types easy to diagnose and a few others such as are more commonly missed. For a more general discussion of the subject the reader is referred to my articles published elsewhere.

Case I (A62,923).—This patient was a man aged forty-three years. He was examined January 9, 1912. He had had a goiter since childhood, but with no marked growth at any time until three weeks before examination, when he noticed a small hard nodule just above his old goiter. Within three days this nodule grew to the size of a hen's egg. Since then it had grown rapidly and from the left toward the right side.

On examination a tumor of the left lobe, 7.5 by 11 cm. in diameter, was found. It was a very hard, fixed, smooth growth which had pushed the trachea far to the right. The boundaries of the tumor were not well defined. In addition, two small nodules, about 2 cm. in diameter, were found on the left side. The patient's weight up to three weeks before examination was 160 pounds; his weight at the time of examination was 139 pounds. His physician said that two or three weeks before examination he had been jaundiced, but, though still sallow, the jaundice had disappeared. During the last ten days he had had considerable pain from the goiter up the left side of the neck to the ear and some slight pain in the corresponding region on the right side. For three weeks he had had some distress in the epigastrium. He had a slight strangling cough with some dyspnea.

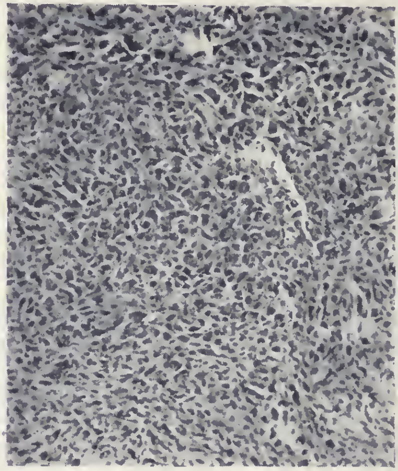

Fig. 532.—Case I (A62,923.) Small spindle-cell sarcoma of thyroid (× 100).

January 11, 1912 operation revealed a tumor attached to the trachea and to the mediastinum; 130 gm. of tissue was removed.

Some areas of the tumor tissue (sarcoma) were composed almost entirely of small spindle-cells, shown in Fig. 532, and others of round and giant-cells, shown in Fig. 533.

The patient died at his home one month after operation, and no necropsy was obtained. The long previous history of goiter in this case, with exceedingly rapid growth of the tumor for a brief period before death, the mixed type of cells and the rapid termination in death are all characteristic of sarcoma of the thyroid. From careful histologic studies of 19 cases of sarcoma of the thyroid which I have made, however, I am convinced that all of them can be best explained on the basis of a long persistent proliferating adenoma which for some reason finally takes on exceedingly malignant characteristics with small round, spindle- or giant-cells making up the body of the tumor.

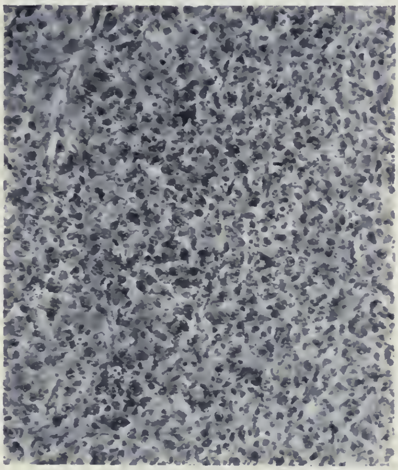

Fig. 533.—Case I (A62,923.) Round- and giant-cell sarcoma. Another area from the same specimen as that shown in Fig. 532 (× 100).

Case II (A82,471).—This patient was a woman aged fifty-six years, married. She was examined April 4, 1913. She had had goiter for thirty years, with rapid growth for one year, associated with much loss of strength and some loss of weight. During the last seven months her trouble had been growing worse and she had had great dyspnea and cough.

Examination showed that her vocal cords were paralyzed. An emergency operation was performed April 9, 1913 to relieve

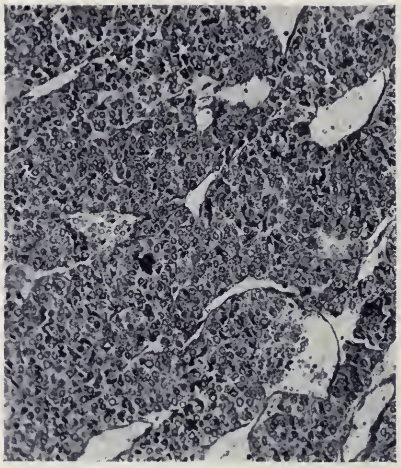

Fig. 534.—Case II (A82,471.) Adenocarcinoma of thyroid, apparently evolved from proliferating adenoma (× 100).

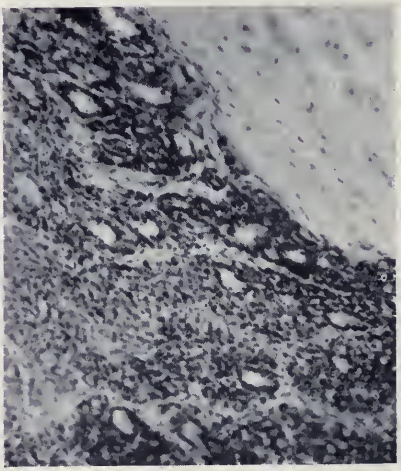

Fig. 535.—Case II (A82,471.) Adenocarcinoma of thyroid invading tracheal cartilage. From same specimen as that shown in Fig. 534 (× 100).

the dyspnea. It was found that a tumor of the thyroid had penetrated the trachea on the right side for about 3 cm. A small ball of tumor tissue projected entirely across the trachea and fitted into a depression on the opposite side, thus almost completely shutting off air. The thyroid surrounding the trachea at this level was soft and degenerated. The patient died a few days after operation and necropsy did not reveal metastasis.

The general histologic character of the tumor is shown in Fig. 534. Apparently it is an adenocarcinoma developing on a proliferating adenoma. The histology of that portion of the tumor which had invaded the trachea is shown in Fig. 535.

In this case the origin of the tumor from a proliferating adenoma was strongly suggested. It should be noted that the rapidly fatal result in this case was apparently not due to a different type of tissue, but to the unfortunate circumstance of the tumor's being directed toward the trachea rather than away from it.

These cases illustrate two rapidly fatal types of thyroid tumors. While not rare, they are by no means as frequent as the tumors which develop slowly, and even if examined early microscopically they are not ordinarily recognized as malignant and are seldom followed up long enough by the clinician or to the necropsy table by the pathologist to determine their really malignant character. The following cases are illustrative of the much more numerous group of slowly developing tumors:

Case III (A143,174).—This patient was a man aged forty-five years. He was examined October 12, 1915. He had had a tumor on the right side of his thyroid for three years, which had given occasional pressure symptoms. About six months before examination his breath began to grow short. During the past four months his weight had been reduced from 210 to 167 pounds. In the past three and a half months his general strength had been materially reduced.

A clinical diagnosis of substernal goiter was made. An exploratory operation was performed October 22, 1915, and 25 gm. of tissue was removed from the right lobe of the thyroid near the trachea. This tissue consisted of a small portion of thyroid and an adherent lymph-gland.

Figure 536 shows that the thyroid tissue consisted of a rather large celled adenocarcinoma. In the upper portion of the section

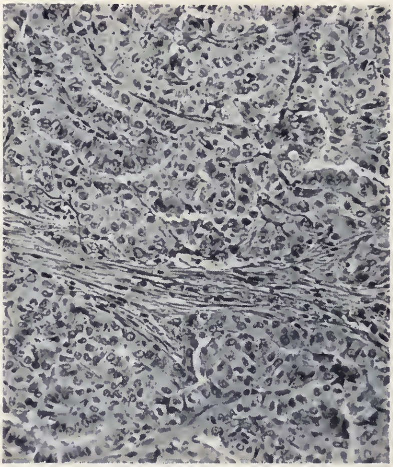

Fig. 536.—Case III (A143,174.) Large cell adenocarcinoma of thyroid showing papilla formation in upper portion. The lower portion is apparently a development from proliferating adenoma (× 100).

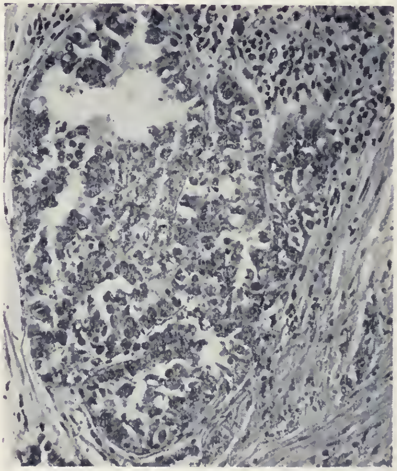

Fig. 537.—Case III (A143,174.) Metastatic adenocarcinoma of thyroid within lymph-gland. From same specimen as that shown in Fig. 536. The tumor in this area is markedly papillomatous (× 100).

some evidence is shown of papilla formation. Figure 537, a photograph of a section from the lymph-gland, shows the markedly papillomatous type of the metastatic growth.

Seven months after operation the patient's physician reported that the patient was still living and at work, but that two large nodules had developed at the site of operation.

Eight months after the operation the patient returned for examination. The tumor had grown slowly and now extended up toward the right lobe. The patient's general condition was greatly improved. His weight had increased to 204 pounds. His breathing was easier and he had not had dysphagia. During the period he had had twenty-eight injection treatments of Coley's serum.

Three years and nine months after the first operation the patient was again examined by a very competent surgeon who reported to the Clinic, "I have just examined Mr. ———. At the present time he has quite a large growth with tracheal distress. The growth seems quite movable with the exception of the point of attachment to the trachea. If he had not been able to give a diagnosis of malignancy from such a good source, I would rather have questioned it on account of the length of time which has elapsed and the general aspect of the patient."

And yet, in less than one month after this report, this patient died of carcinoma of the thyroid with diffuse metastasis to the lungs.

This is rather a typical instance of ordinary slow-growing adenocarcinoma of the thyroid. The age of the patient, the history of goiter for several years, the recent increase of growth, with local pressure symptoms and loss of weight, the temporary improvement under treatment, the prolonged course of the disease, and the rapid downward course to death at the end, are all characteristic of the usual history of the adenocarcinomatous type of thyroid tumor.

Case IV (A52,976).—This patient was a woman aged twenty-eight years, married. She was examined May 12, 1911. She had had goiter since childhood, which had increased in growth during the last year. She had always been nervous, but had been growing more so during the last year. She had had no dyspnea.

Examination revealed a tumor of the right lobe of the thyroid 6 by 7.5 cm. in diameter and very much enlarged cervical glands which she thought had been enlarged for five or six years. Her general strength was good. A clinical diagnosis of cystadenoma of the thyroid was made.

May 18, 1911 the right lobe and isthmus of the thyroid, consisting of 135 gm. of tissue, were removed at operation. The gross appearance of the gland in transverse section is shown in Fig. 538.

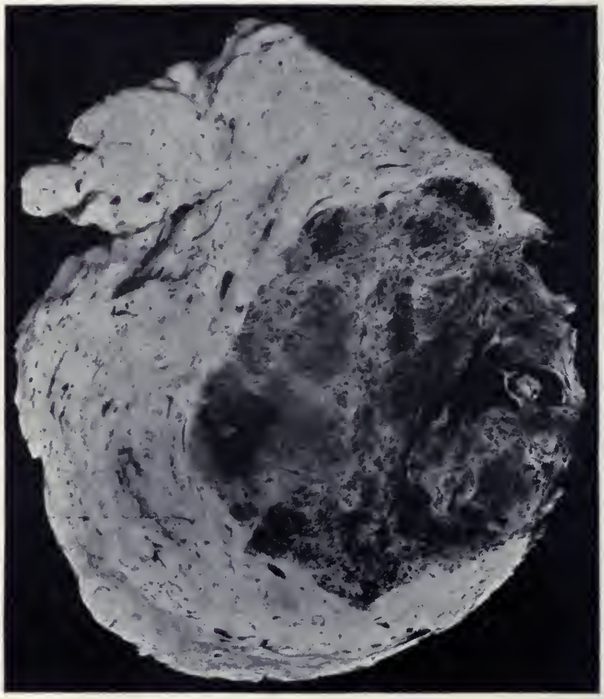

Fig. 538.—Case IV (A52,976.) Transverse section of tumor of right thyroid removed at first operation. The circular dark area is degenerating colloid adenoma. The surrounding light crescentic area is a proliferating "fetal adenoma" ("wucherende Struma," Langhans) histologically resembling that shown in Fig. 540. In a few areas at the line of demarcation between the two types of tissue and at the periphery of the tumor the tissue is apparently rapidly proliferating and is papillomatous (Fig. 539) (× 100).

The loose central portion was degenerating colloid adenoma. The more dense whitish crescentic mass was a "fetal adenoma," with relatively small cells and large nuclei similar to that shown in Fig. 540. In some areas at the periphery of the nodule and in others near the line between the degenerated portion and the more solid portion the tissue appeared to be an actively growing papilloma, as shown in Fig. 539.

Notwithstanding the age of the patient, a diagnosis of early papillomatous carcinoma was made and roentgenographic treatment instituted.

The patient remained well until she bore 2 healthy children. The first child was born two years and the second four years and nine months after her operation. In August, 1916, one month after the birth of her last child, the remaining thyroid tissue on the right side began to grow rapidly. She had no disturbance of breathing and no nervousness, but considerable pain in the lower back.

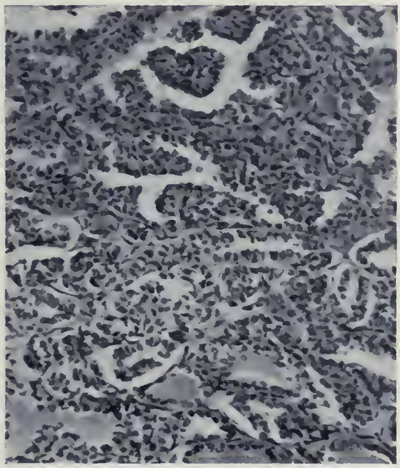

Fig. 539.—Case IV (A52,976.) Papillomatous adenocarcinoma of right thyroid, from areas described under Fig. 538 (× 100).

The patient returned to the Clinic November 24, 1916, and a slightly hard movable tumor, 3 by 5 cm. in diameter, was found.

November 30, 1916 26 gm. of tissue was removed partly from the right and partly from the left lobe of the thyroid.

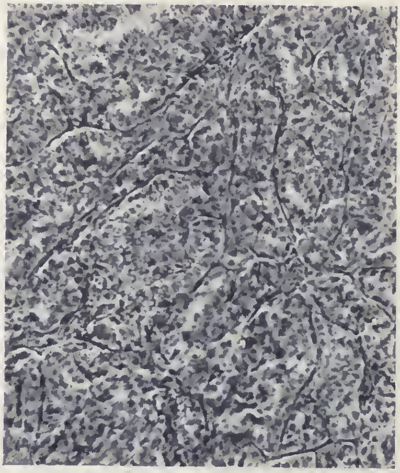

Fig. 540.—Case IV (A52,976.) Proliferating adenoma (carcinomatous?) of thyroid; from left lobe of thyroid specimen removed five and one-half years after first operation on right lobe (× 200).

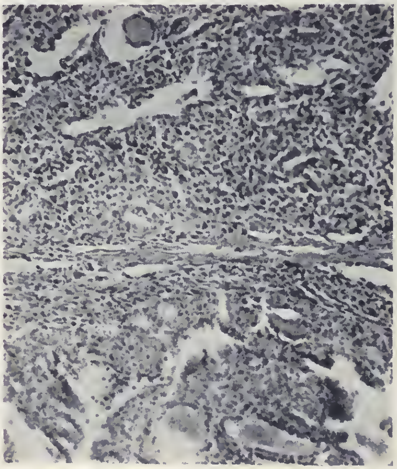

Fig. 541.—Case IV (A52,976.) Papillomatous adenocarcinoma of right thyroid removed from same patient five and one-half years after first operation. Upper portion of figure shows same type of tumor as that shown in Fig. 539 (from first operation). Lower portion shows colloid goiter.

The character of the tissue from the left lobe is shown in Fig. 540. It is a proliferating "fetal adenoma" like that constituting the larger portion of the more solid areas removed at the first operation (Fig. 538). The tissue from the right side consisted of a small lymph-gland in immediate contact with a portion of the thyroid. The lymph-gland contained metastatic carcinoma (upper portion of Fig. 541), while the thyroid in immediate juxtapostion thereto was colloid goiter (lower portion of Fig. 541).

The patient died two weeks after her last operation. At necropsy the lungs were found filled with small metastatic nodules. The tissue in the larger of these, some of which were 5 mm. in diameter, microscopically (Fig. 542) was almost exactly like that found in the thyroid at the first operation five and a half years before (Fig. 539). The edge of a small nodule, about 2.5 mm. in diameter, with a bit of its surrounding lung tissue is shown in Fig. 543.

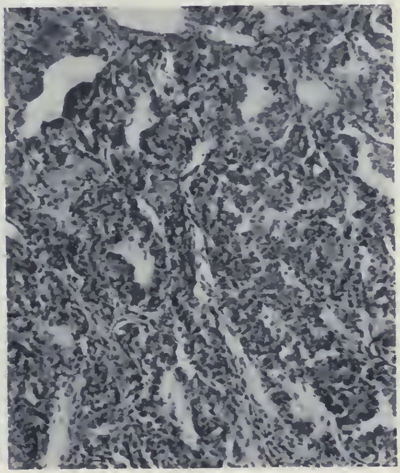

Fig. 542.—Case IV (A52,976.) Papillomatous adenocarcinoma of thyroid metastasizing to lung five and one-half years after first operation. Note resemblance to tissue shown in Fig. 539, removed at first operation (X 100).

This patient's age (twenty-eight years), her nervousness, and the presence of a thyroid tumor might have led a careless observer at the time of her first examination to a diagnosis of exophthalmic goiter, and, indeed, it may be that the papillomatous overgrowth of thyroid tissue may have had something to do with her nervousness, but she had no other symptoms of exophthalmic goiter. These same factors and her return to health for almost five years after her first operation made the initial pathologic diagnosis of early carcinoma seem absurd during that time. The case illustrates the importance of thoroughly examining all portions of removed thyroid tissue and of following up all suspicious cases for long periods of time, even when reports from patients and physicians continue most favorable. The surgical and roentgenographic treatment may have been considerable factors in the prolongation of this patient's life.

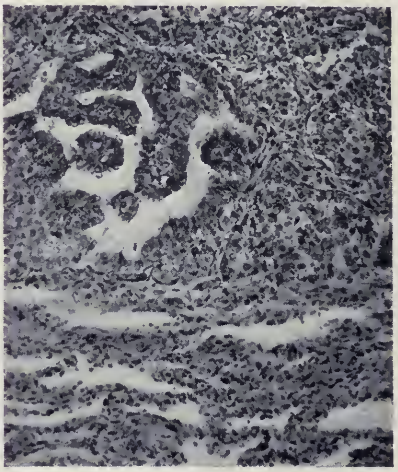

Fig. 543.—Case IV (A52,976.) Papillomatous adenocarcinoma in a small metastatic nodule in the lung. Note resemblance in upper right-hand corner of this section to the tissue shown in Fig. 540 (from left thyroid), and in upper left-hand corner to tissue shown in Fig. 539 (from right thyroid) (× 100).

Case V (A42,843).—This patient was a man aged sixty-one years, and married. He was examined September 5, 1910. He had had goiter for twelve years, with gradual enlargement, but without symptoms other than slight pains and weakness recently.

On examination, a left-sided, somewhat hard goiter 8 by 8 cm. in diameter was found. There was a slight bruit, but no thrill. The larynx was pushed to the left. A clinical diagnosis of cystadenoma of the thyroid was made.

December 8, 1910 a proliferating fetal adenoma weighing 270 gm. was enucleated from the left lobe of the thyroid.

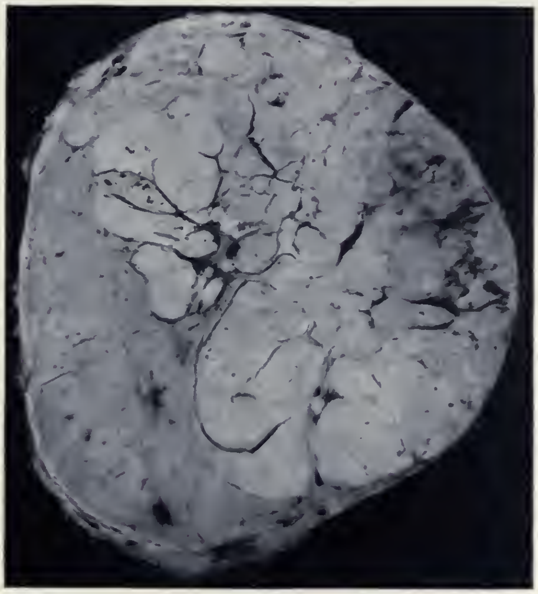

Fig. 544.—Case V (A42,843.) Transverse section of proliferating "feta adenoma" of left thyroid removed at first operation. The dark colored tissue in the lower left portion of the section is of ordinary colloid type. The lighter colored tissue in the upper right portion of the section is typical proliferating adenoma ("wucherende Struma," Langhans). The histologic characteristics of the tissue in this area are shown in Fig. 545 (× $\frac{2}{3}$).

The gross appearance is shown in Fig. 544. The histologic appearance of the more solid (whitish) portions of the tumor is shown in Fig. 545.

This patient remained well after his operation for nearly five years, when a small nodule appeared over the middle of the thyroid. This nodule gradually enlarged without causing symptoms. Three and one-half years later, or about eight and one-half years after his first operation, he noticed a small firm mass over the upper sternum below the level of the clavicle, but without connection to the tumor above. This mass enlarged very slowly without tenderness and with only occasional darting pain. After a few months a small amount of bloody material was discharged from the lower portion of the mass. The wound closed under home treatment, but the patient returned to the Clinic for examination February 14, 1920, nine years and two months after his first operation.

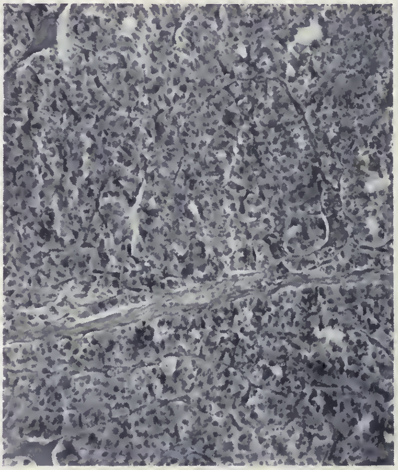

Fig. 545.—Case V (A42,843.) Proliferating "fetal adenoma" ("wucherende Struma," Langhans) from light colored area shown in Fig. 544 (X 100).

February 20, 1920 a tumor about 6 by 8 cm. in diameter attached to the sternum, and one about 2 by 2 cm. in diameter attached to the trachea, together with a considerable amount of surrounding tissue, were removed, the total weight of tissue being 280 gm.

Microscopic examination showed extensive local infiltration of the surrounding tissues by an adenocarcinoma of the thyroid. The character of the infiltrating growth is shown in Fig. 546.

July 6, 1921 the patient's physician reported that the patient "was suffering from considerable soreness, pain, and a hard swelling in the location where the goiter was." These symptoms no doubt indicate serious local recurrence.

In this case more than nine years elapsed after the first operation before the return of the tumor caused the patient again to consult a physician. In the meantime the character of the tumor had not materially changed histologically, but it had slowly infiltrated surrounding tissues. It will no doubt soon result in the death of the patient.

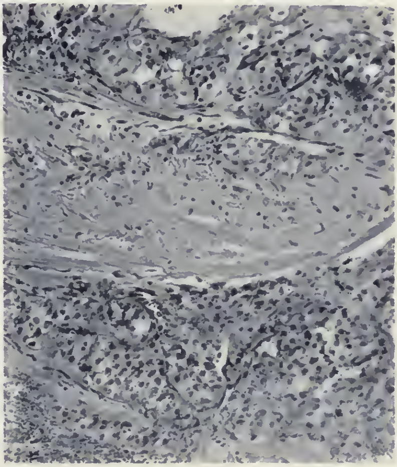

Fig. 546.—Case V (A42,843.) Adenocarcinoma infiltrating tissues of neck from same patient as specimens shown in Figs. 544, 545, but removed nine years and two months after removal of specimen shown in these figures. Note the close resemblance of this tissue to that shown in Fig. 545 (× 100).

Of the 290 patients with malignant tumors of the thyroid who were examined in the Mayo Clinic from January 1, 1901 to January 1, 1921, 158 had certainly developed goiter before they were thirty years of age. Only 61 of the patients had not noticed any thyroid enlargement previous to one year before the diagnosis of malignancy was made. This long persistence of tumors of the thyroid before malignancy is demonstrated is one of the chief causes of error in diagnosis. So far as the actual clinical evidences of malignancy are concerned, only about one-fourth of the 290 patients had noticed symptoms of markedly accelerated thyroid growth for one year or less. About one-third had noticed symptoms of continuous growth for ten years or more. Thus, while a sudden increase in rate of growth of a long-standing nodular tumor of the thyroid in a patient more than thirty-five years of age is strongly indicative of beginning malignancy, a slow continuous growth of a nodular tumor may be almost equally indicative of the same condition.

The more one studies the pathology of tumors of the thyroid, the more he is led to believe that they all have their origin in proliferating "fetal adenomas" ("wucherende Struma" of Langhans). All other types of the different histologic structures are theoretically derivable from this type. In many instances the histologic changes can be traced step by step in different portions of the same tumor and in different tumors removed from the same patient at different times. This hypothesis would go far toward explaining the slow development of most thyroid tumors.

It is most important that the clinician and the pathologist should remember that all nodular tumors of the thyroid when removed should be carefully examined histologically in every portion. If markedly proliferating adenomatous tissue is found the tumor should be considered potentially malignant. The prognosis should depend, aside from the general condition of the patient, on the relative preponderance of degenerative and regenerative processes in the tumor. And, finally, all patients from whom nodular tumors of the thyroid have been removed should be kept under observation, if necessary, for at least ten years, until the true character of any subsequently developing tumor has been determined clinically and pathologically.

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CLINIC OF DR. WILLIAM J. MAYO

SPLENIC SYNDROMES

Many diseases have been named on the basis of a purely symptomatic syndrome, the names being merely convenient hooks on which to hang a miscellaneous assortment of obscure conditions. The absence of definite etiology and pathology, however, is somewhat compensated for by a rather definite symptomatology which gives an appearance of reality to obscurity. For many reasons disease syndromes of the spleen have been most remarkable in this respect. The spleen is an organ whose removal in health causes no profound or permanent change in the human economy, whose function, such as it may be, is readily taken over by other organs or tissues, and whose diseases are capable, directly or indirectly, of producing most serious constitutional changes which may lead to death.

A survey of these so-called splenic syndromes should not be too closely concerned with the details, but it should rather be an attempt to obtain a perspective of the phenomena as a whole. The most interesting of the splenic syndromes are those which concern the blood. The blood may be looked on as tissue in the form of fluid, instead of a connective-tissue medium, its function being to carry oxygen and food to the tissues, to remove from them the ash and waste products, and, in addition, to carry noxious agents of all sorts which may gain entrance to the blood, to the kidneys, mucous membrane, and skin for elimination, or to the vital laboratories, of which the liver is chief, for defense. The spleen, considered from this broader conception, is concerned with the purification of the blood, and is one of the agents whereby worn-out red blood-cells and infectious or toxic material of various kinds are filtered from the blood-stream and directed to the liver, the great metabolic and detoxicating organ of the body. In other words, the function of the spleen and the pathologic misfortunes which it sponsors concern chiefly the bloodstream. It would appear that the spleen is not the principal agent, but that it is rather an agent of destruction through which the damage is brought about.

Always it is our desire to place our hands definitely on a certain organ and say, "Here is the trouble," but indefiniteness lurks around the spleen. Even when splenectomy results in alleviation of symptoms, or in cure, we are by no means convinced that the spleen was the cause of the ailment. We are only sure that by removing it we have eliminated an organ of destruction or perhaps broken a vicious circle. It is my purpose at this time to speak of five syndromes in which the spleen may play a prima donna rôle. Four of these—splenic anemia, pernicious anemia, hemolytic icterus, and polycythemia—concern the erythrocytes, and one—splenomyelogenous leukemia—concerns the leukocytes.

Within a brief period I have splenectomized 10 patients because of syndromes connected with the pathology of the blood; 4 had splenic anemia, 1 pernicious anemia, 2 hemolytic icterus, 1 splenic polycythemia, and 3 splenomyelogenous leukemia. The histories of 6 of the 10 patients have been selected to illustrate the five conditions.

SPLENIC ANEMIA

Case I (A352,499).—Mr. F. B., aged forty-seven years, came to the Clinic March 15, 1921, complaining of pain in the epigastrium. Six months before he had suffered from a feeling of fulness in the epigastrium immediately after meals, which had subsided as time for the next meal approached. During the last ten days he had had a dull aching pain in the epigastrium when the stomach was empty; food in the stomach had relieved the pain. There had been no symptoms of dyspepsia, no nausea, or vomiting. He had lost 8 pounds in weight during the last few months.

Examination revealed palpable lymph-nodes in the cervical region, prominent veins in the epigastrium, and an enlarged spleen reaching to the level of the umbilicus. The urine contained an occasional pus-cell. Roentgenograms of the chest and stomach were negative. The Wassermann reaction on the blood and an examination of the spinal fluid were negative. The blood findings are given in Table 1. A provisional diagnosis was made of splenic anemia.

March 24th the patient was splenectomized. The spleen was found to be about three times normal size, very adherent, and much creased on the surface. The liver was moderately cirrhotic. A specimen was removed for microscopic diagnosis (Fig. 547). In removing the spleen considerable hemorrhage occurred, and it was necessary to leave a gauze pack in the wound, the end of which was brought out through a stab wound between the twelfth rib and the anterior superior spine of the ilium. The pack was removed in forty-eight hours. The convalescence was characterized by increased temperature for twenty-one days and pain in the splenic area. The patient was dismissed after thirty-one days. He has steadily improved and has returned to his occupation.

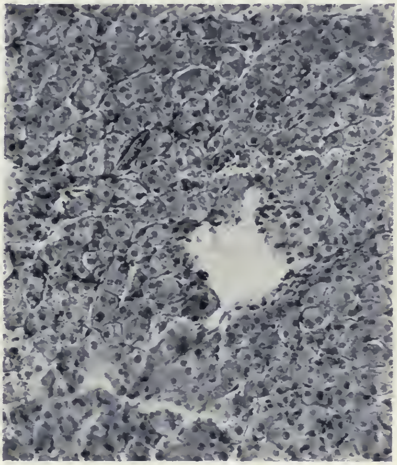

Fig. 547.—(Case 352,499.) Splenic anemia; chronic cirrhosis of liver with beginning atrophy of cells (× 100).

Table 1

BLOOD FINDINGS

(Case A352,499)

Date	3/15/21	3/24/21	5/3/21	5/27/21		9/29/21
Hemoglobin, per cent	72.0	Splenectomy.	63.0	70.0	Convalescence uneventful.	65.0
Erythrocytes, millions	4.4		4.34	4.62		4.29
Leukocytes	5800		10,600	11,600		9900
Polynuclears, per cent	82.0		....	52.0		
Small lymphocytes, per cent	11.5		....	32.5		
Large lymphocytes, per cent	4.5		....	9.0		
Eosinophils, per cent	2.0		....	4.5		
Basophils, per cent	...		....	1.5		

Comment.—This patient was in poor condition; he was anemic, and tired easily. He had been compelled to take a prolonged vacation, but was not benefited. The first month after the splenectomy he did not show much improvement; the leukocytes increased and the anemia continued. He then began to improve, and in three months had reached his former vigor. Six months after operation he was examined and found to be normal in every respect. He felt better than he had for years and was able to carry on his important work.

SYPHILITIC SPLENIC ANEMIA

Case II (A366,956).—Mrs. H. M., a housewife aged thirty-nine years, came to the Clinic August 2, 1921 because of an enlarged abdomen. Her mother had died of cancer of the liver. The patient had been married fifteen years; she had had one miscarriage, but no children. She had had diphtheria, scarlatina, influenza, pneumonia, pleurisy, malaria, syphilis, and gonorrhea. At the age of sixteen sores appeared around the vulva; at the age of twenty-five the throat was ulcerated for four months. In 1919 she had noticed that her abdomen was gradually increasing in size and that the lower extremities were markedly edematous. A positive Wassermann reaction on the blood had been discovered by her home physician, and the liver found to be enlarged; thorough treatment for syphilis elsewhere somewhat reduced the size of the liver.

Examination revealed marked abdominal ascites and edema of both legs; the spleen extended to the level of the umbilicus. The Wassermann reaction on the blood was strongly positive. A diagnosis was made of syphilitic hepatitis with splenomegaly. The blood findings are given in Table 2.

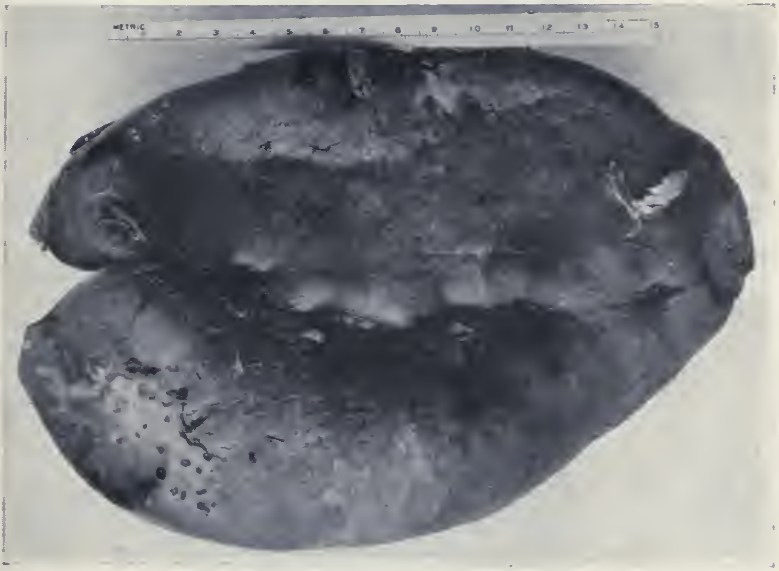

Fig. 548.—(Case 366,956.) Syphilitic splenic anemia; fibrosis and perisplenitis; weight of spleen 950 gm.

August 11th operation was performed. The liver was markedly cirrhotic, nodular, and about one-half the normal size. The spleen, which weighed 950 gm. and was gorged with venous blood, was removed (Figs. 548–550). About 12 liters of fluid were drained from the abdomen. The convalescence was stormy and two blood transfusions were necessary.

September 25th the patient died. Necropsy revealed thrombosis of the portal vein, fat necrosis of the pancreas, and syphilitic cirrhosis of the liver, with ascites.

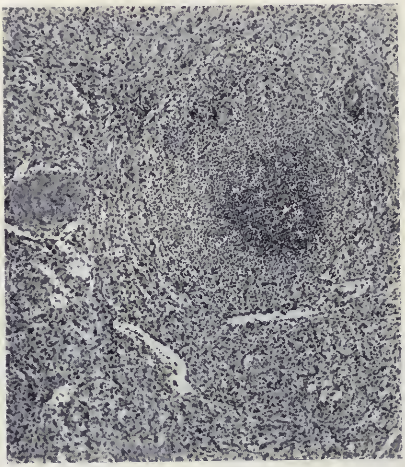

Fig. 549.—(Case 366,956.) Extensive fibrosis with almost complete destruction of splenic pulp; one small area of practically normal splenic tissue (× 50).

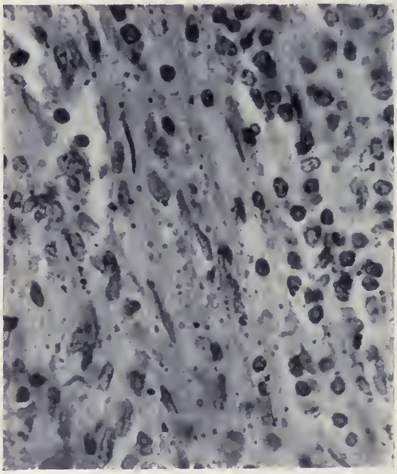

Fig. 550.—(Case 366,956.) Many fibroblasts and a few lymphocytes (× 500).

TABLE 2

BLOOD FINDINGS

(CASE A366,956)

Date	8/2/21	8/5/21	8/11/21	8/24/21	9/19/21	9/25/21
Hemogoblin, per cent	62.0	64.0	Splenectomy.	Transfusion 500 c.c.		Patient died—syphilitic cirrhosis of the liver.
Erythrocytes, millions	4.0	3.94				
Leukocytes	5800	3800			21,700	
Polynuclears, per cent	....	79.0				
Small lymphocytes, per cent	....	18.0				
Large lymphocytes, per cent	....	2.0				
Eosinophils, per cent	....	1.0				

Comment.—This case illustrates the syphilitic type of splenic anemia in its terminal stage. The patient had been treated vigorously for two years for syphilis; one course of six treatments of salvarsan had been given recently. She was slightly icteric, greatly emaciated, edematous in the lower extremities, and ascitic to such an extent that she was unable to walk without assistance. At the time she was operated on her general condition was so poor that a bed-sore was beginning to form on the buttock. The patient was mentally remarkably vigorous. She urged strongly her right to a chance. It was agreed that the abdomen should be explored, and if the spleen could be removed without risk of death on the table, it should be done. Under local and ether anesthesia the abdomen was opened in the middle line; 12 liters of fluid were evacuated and the spleen removed. The liver was remarkably cirrhotic and was about 4 by 15 by 25 cm. The convalescence was stormy, but the patient improved greatly and was able to leave the hospital at the end of thirty days. Improvement continued until a few days before her death, when she suddenly developed dyspnea, which passed into coma.

PERNICIOUS ANEMIA

Case III (A351,155).—Mr. C. G., a farmer aged thirty-nine years, came to the Clinic March 2, 1921 because of weakness. Appendectomy had been performed in 1912, and he had had influenza in 1918. Since 1911 he had been conscious of a vague distress in the epigastrium associated with belching. His tongue had been sore at intervals for four years. In the spring of 1920 he had begun to lose color and to feel weak; the hemoglobin had been 38 per cent. A transfusion had relieved the symptoms for a time, but in November they returned, and two transfusions did not relieve him. The fingers and toes occasionally had been numb and tingled. He had palpitation and dyspnea, and had lost 7 pounds in weight.

The skin was yellow. The spleen could be palpated 3 cm. below the costal margin. The tongue was bald. Achlorhydria was present and a Roentgen-ray examination of the stomach was negative. The Wassermann reaction on the blood was negative. The stools were negative for parasites. On neurologic examination there was evidence of early combined sclerosis. The blood findings are recorded in Table 3. The diagnosis was pernicious anemia. Splenectomy was decided on because of the patient's failure to improve after four transfusions.

April 9th operation was performed, and a large adherent spleen, dark in color, resembling that of hemolytic icterus, and weighing 560 gm. was removed. A transfusion of 500 c.c. was given after the operation.

The patient was dismissed from the hospital April 20th and went home. He had many of the same symptoms as before the operation, but he gained 20 pounds in weight and his blood count improved markedly. In June he again began to lose weight and became weak; August 11th, when he returned to the Clinic, the hemoglobin was 10 per cent. and the erythrocytes 750,000. Five transfusions have been give. The erythrocytes are now more than 2,000,000 despite an intercurrent bacillary dysentery.

TABLE 3

BLOOD FINDINGS

(CASE A351,155)

Date, 1921	3/2	3/10, 3/17, 3/25, and 4/5	4/7	4/9	4/22	4/28	4/30		8/11	8/11, 8/16, 8/22, 8/29, and 9/5	9/10	
Hemoglobin, per cent	27.0	Transfusions.	37.0	Splenectomy.	34.0	Transfusion 500 c.c.	42.0	Patient returned.	10.0	Transfusions.	35.0	Patient still under treatment.
Erythrocytes, millions	1.02		1.89		1.87		2.36		0.75		2.09	
Color-index	1.3											
Leukocytes	2100		1500		4300		4800		2800		1500	
Polynuclears, per cent	47.0		45.0									
Small lymphocytes, per cent	47.0		48.0									
Large lymphocytes, per cent	3.5		4.5									
Eosinophils, per cent	....		1.5									
Basophils, per cent	2.0		0.5									
Neutrophilic myelocytes, per cent	0.5											
Normoblasts	9		2									
Anisocytosis	Moderate		Marked									
Poikilocytosis	Moderate		Marked									

Comment.—It will be noted that a large adherent spleen was removed, and that seven transfusions of blood were given following operation. The patient gained 20 pounds in weight in two months and then he gradually became worse. He returned to the Clinic and was given five transfusions; he is still under treatment.

Giffin and Szlapka traced 50 patients who had been splenectomized in the Clinic for pernicious anemia four years before, and found that 21.3 per cent. lived more than three years after operation, and 10.6 per cent. more than five years. These splenectomized patients lived on an average two and one-half times as long as a comparable group of non-splenectomized patients with pernicious anemia. It would seem that the spleen was not the cause of the pernicious anemia, but rather an agent of destruction; that the formation of erythrocytes was defective, and as one of the functions of the spleen is the destruction of worn-out corpuscles, these subnormal corpuscles, the best the patients could produce, were unnecessarily sacrificed. The removal of the spleen checked the unnecessary destruction of blood. Three deaths occurred in the first 19 cases of splenectomy for pernicious anemia in the Clinic. These patients were operated on during crises and while they were on the down-grade. All the patients operated on since that time (39) have recovered from the operation. Splenectomy should be done while the patient is on the up-grade, such as following blood transfusion.

HEMOLYTIC ICTERUS

Case IV (A363,148).—Mrs. F. S., aged thirty-five years, came to the Clinic June 29, 1921. She was jaundiced and complained of having had for years a dull, aching pain in the left side which was enlarged. She had been married seventeen years and had had 4 children, all of whom were living and well. Her menstrual periods had begun at the age of seventeen and were normal. She had had a slight flow before and after the last period, which was one week before examination. On careful questioning it was learned that since 1916 she had had constant slight jaundice. Her family physician believed that her spleen was then palpable. She had had tonsillitis and rheumatic fever. Since 1917 she had had attacks of severe pain which lasted for from a few hours to several days and were accompanied by nausea and vomiting, and followed by jaundice and dark colored urine. The pain began in the left hypochondrium, but it shifted quickly to the epigastrium. The attacks had occurred two or three times a year, but during the three weeks previous to examination she had had an attack every three or four days, during which the pain had been so severe that morphin had been required. Her physician had diagnosed the mass in the upper left abdomen an enlarged spleen.

Examination revealed the patient to be poorly developed, somewhat dyspneic, and deeply jaundiced. The spleen was low, extended into the left iliac fossa, and beyond the umbilicus. It was easily palpable. The systolic blood-pressure was 92, the diastolic 58. Two examinations of the urine showed no bile. The roentgenogram of the stomach was negative. The Wassermann reaction on the blood was negative. The blood findings are recorded in Table 4. The color-index, it will be noted, was high, but the blood-smears did not show the characteristics of pernicious anemia and the reticulated cells were numerous. The fragility of the erythrocytes in circulation was increased. The examination of the duodenal contents revealed 24,000 units of urobilinogen and urobilin. A diagnosis was made of hemolytic jaundice and gall-stones.

July 9th operation was performed. The spleen was found to be enlarged to about three times normal size (775 gm.), and showed the usual dark color of hemolytic icterus. The gall-bladder was distended with stones. There was considerable bloody serum in the abdominal cavity. The spleen, the gall-bladder, the left fallopian tube, which contained a ruptured extra-uterine pregnancy about 9 cm. in diameter, were removed.

The convalescence was uneventful.

Table 4

BLOOD FINDINGS

(Case A363,148)

Date	6/29/21	7/1/21	7/9/21
Hemoglobin, per cent	68.0	65.0	Splenectomy. Convalescence uneventful.
Erythrocytes, millions	3.12	3.5	
Color-index	1.0	0.9	
Leukocytes	8800		
Polynuclears, per cent	83.0		
Lymphocytes, per cent	13.5		
Mononuclears, per cent	3.0		
Eosinophils, per cent	0.5		
Anisocytosis	Slight		
Poikilocytosis	Slight		

Comment.—Splenectomy for hemolytic icterus is one of the triumphs of modern surgery. Patients who, perhaps, have been jaundiced for an entire lifetime, within four days become free from the jaundice and there is rapid improvement in the anemia. In 30 cases there has been but one death, and this was a patient who was operated on during a crisis, when the temperature was 102° F., the jaundice was increased, and there was marked tenderness over the spleen and the liver. Patients should not be operated on during a crisis.

PRIMARY POLYCYTHEMIA

Case V (A253,491).—Mr. O. L. P., aged thirty-one years, registered in the Clinic December 13, 1918. He had had bronchopneumonia, tonsillitis for which tonsillectomy had been performed in 1915, rheumatic fever, bilious attacks since childhood, and in 1905 a severe attack of jaundice. In June, two hours after meals, he had had attacks of rigidity with epigastric pain, which had lasted one hour. The pain had been accompanied by diarrhea, but no vomiting or fever. The attacks had persisted for one week. August 26th epigastric pain had been so severe that morphin was required for relief. The abdomen had been greatly distended; the leukocytes had numbered 25,000. A diagnosis of perforating gastric ulcer had been made. On abdominal exploration elsewhere an enlarged spleen with engorgement of the perisplenic veins and the mesenteric vessels had been found. One week later the hemoglobin had been 106 per cent.; the erythrocytes had numbered 9,000,000. *Endameba histolytica* had been found in the stools and the patient had received treatment for this condition. Pain had reappeared in the epigastrium.

On examination, the patient was markedly erythrotic. The spleen extended almost to the level of the umbilicus and the midline. The urine contained an occasional pus-cell. The Wassermann reaction on the blood was negative. The eyegrounds showed slight venous engorgement and hyperemia of the nerve head. The fragility test of the erythrocytes was normal. The blood findings are given in Table 5. The hemoglobin estimations were made by the Dare method, and would be higher if the acid hematin method had been employed. Diagnosis of primary polycythemia with chronic septic splenomegaly was made.

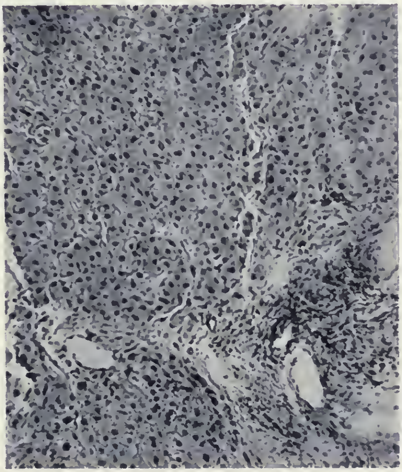

Fig. 551.—(Case 253,491.) Primary polycythemia; peribiliary and perivascular cirrhosis of the liver, with lymphocytic infiltration (× 100).

The patient was dismissed from the Clinic, but he returned several times for observation. February 14, 1919 a severe hemorrhage from the stomach occurred; in October, 1920 a small hemorrhage; and in May, 1921 a severe hemorrhage from the bowel; the patient also vomited blood. During June, 1921, he had phlebitis in the calf of the right leg which kept him in bed for one week.

September 12, 1921 the spleen was removed; it weighed about 900 gm. and was deeply buried in a mat of adhesions to the liver, stomach, omentum, and abdominal wall. There were many huge veins in the splenic region. No gross pathologic condition other than in the spleen was found in the abdomen. A specimen of the liver was removed for microscopic examination (Fig. 551). The convalescence was uneventful. September 29th the patient was up and about.

Table 5

BLOOD FINDINGS

(Case A253,491)

Date	12/13/18		5/8/19	6/30/21	9/7/21	9/12/21		9/30/21
Hemoglobin, per cent	92.0	Patient returned for observation.	85.0	44.0	62.0	Splenectomy.	Convalescence uneventful.	55.0
Erythrocytes, millions	6.61		6.16	3.2	5.51			4.64
Color-index				0.6	0.8			
Leukocytes	14,000		22,400	23,200	32,300			61,000
Polynuclears, per cent	83.5		79.0	87.5	85.5			
Small lymphocytes, per cent.	9.5		14.5	7.5	10.0			2.0
Large lymphocytes, per cent.	5.0		3.0	1.0	1.5			
Eosinophils, per cent	1.0		2.5	3.5	1.5			5.5
Basophils, per cent	1.0		1.0	0.5	1.5			0.5
Normoblasts	...		...	3				
Anisocytosis				Slight				
Poikilocytosis				Moderate				
Polychromatophilia				Slight				

Comment.—Polycythemia (rubra vera) is not a common disease. This case fulfils all the clinical criteria. The hemorrhage from which the patient suffered shortly before the operation was very severe; the spleen as well as the erythrocytes was considerably reduced as a result. At the time of the operation the blood count showed that he had gained considerably. Careful examination of the abdomen during the operation did not reveal a lesion other than of the spleen. A specimen removed was negative except for mild hepatitis.

It has been believed that the enlargement of the spleen in polycythemia has no particular significance, for when the patients die terminal pathologic conditions are found in other organs. But this case, while it does not permit generalizations, leads us to suspect that the spleen plays a much greater part in the disease than has been credited to it, and that early in its course the conditions found in the other organs at necropsy do not exist. One may well believe that the adult function of the spleen in destroying erythrocytes is much reduced in cases of polycythemia and that its internal secretion greatly overstimulates the bone-marrow in the production of the erythrocytes. The patient was in excellent condition when last observed in November.

SPLENOMYELOGENOUS LEUKEMIA

Case VI (A367,204).—Mrs. C. D., a housewife aged thirty-four years, registered in the Clinic August 3, 1921. She complained of an enlarged spleen. She had been married eleven years and had one child living and well. Her menstrual periods had been regular. She had had typhoid fever in childhood and influenza in 1918. In 1911, during the birth of her child, a severe pain had developed between the shoulder-blades, and later she had noticed a mass in the upper left abdomen. In August, 1920 the mass, which was painless, had become definitely noticeable. She consulted a physician and was told that her spleen was enlarged and that her blood was anemic. Iron preparations had been administered intravenously. The mass had grown larger, and in January, 1921 six Roentgen-ray treatments had been given without any apparent effect. During two weeks in May twelve further treatments had been given, which resulted in a decrease in the size of the mass and in the leukocytes. Two weeks later, however, the mass had again begun to increase in size. The patient had never been jaundiced, her tongue had not been sore, and she had not had gastric disturbances. She had lost 7 pounds in weight during the last three months.

On examination the patient appeared to be well nourished; the skin and mucous membrane were pale. Splenic dulness extended from the fifth rib in the axillary line to the level of the umbilicus, 6.25 cm. to the right of the middle line. Pretibial edema existed in both legs. The systolic blood-pressure was 120, the diastolic 62. The urine contained an occasional pus-cell. The Wassermann reaction on the blood was negative. The fragility of the erythrocytes was slightly increased on three tests; there was, however, no history of jaundice or crises. The blood findings are shown in Table 6. The blood-picture showed an index varying between 1.1 and 0.7, and leukocytes varying

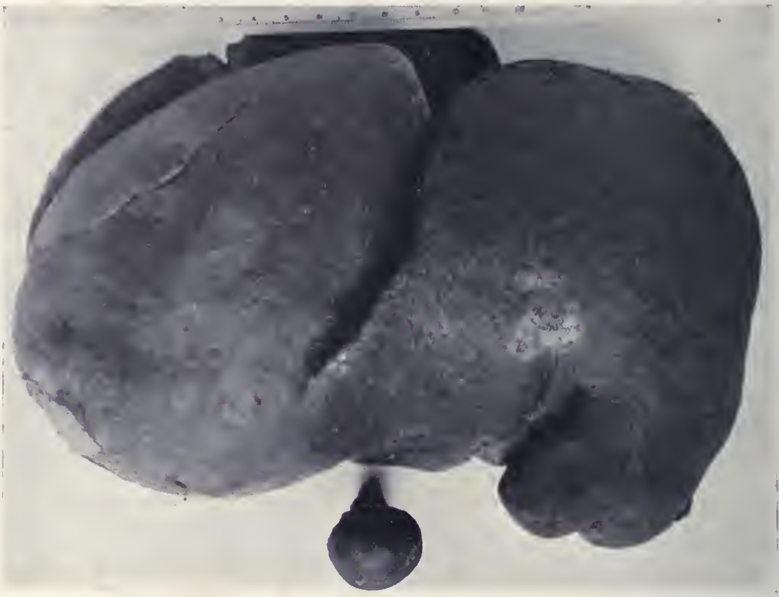

Fig. 552.—(Case 367,204.) Splenomyelogenous leukemia; distinctly lobulated spleen (weight 2360 gm.) with areas of perisplenitis and a small accessory spleen.

between 2300 and 13,000, with an occasional myelocyte in the smears.

September 8, 1921 splenectomy and cholecystectomy for gallstones were performed. The spleen was large (2360 gm.), lobulated, and extensively adherent, especially to the diaphragm and posteriorly. An accessory spleen 2 cm. in diameter found in the splenic pedicle was also removed (Figs. 552, 553). The convalescence was uneventful except for slight pain in the left lumbar region.

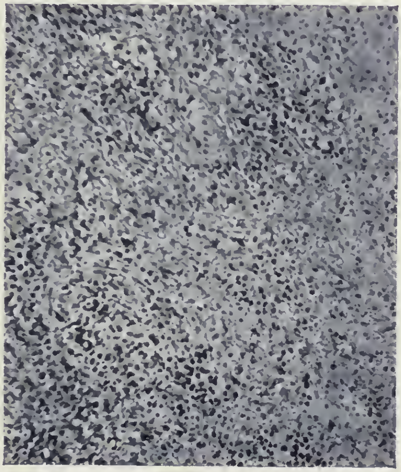

Fig. 553.—(Case 367,204.) Fibrosis of the spleen (× 100).

Comment.—It has been generally believed that if a patient with leukemia were splenectomized he would die at once, or if he did recover, he would not be benefited. However, it is a common experience that any reduction of the size of the spleen reduces the number of leukocytes and improves anemia. In our series of 27 cases of splenectomy for leukemia there was only one death, and that from pulmonary thrombosis two weeks following operation. We reduce the size of the spleen and the number of leukocytes by radium, which has a remarkable effect. When the leukocytes have been reduced to less than 20,000 the spleen can be removed without difficulty. In some cases we have been

TABLE 6

BLOOD FINDINGS

(CASE A367,204)

Date, 1921	8/3	8/8	8/9	8/10	8/15	8/16	8/19	8/22	8/23	8/29	8/31	9/2	9/8	9/17	
Hemoglobin, per cent	46.0	Transfusion, 500 c.c.	28.0	33.0	Transfusion, 500 c.c.	48.0	52.0	Transfusion, 425 c.c.	47.0	50.0	Transfusion, 450 c.c.	45.0	Splenectomy.	55.0	Convalescence uneventful.
Erythrocytes, millions	2.7		1.94	1.86		2.53	2.59		3.33	2.7		2.82		3.79	
Color-index	0.8		0.7	0.9		1.1	1.0		0.7	0.9		0.7		0.7	
Leukocytes	3300		3000	2300		3600	5100		2700	2700		3000		13,000	
Polynuclears, per cent	76.5					83.5			80.5						
Small lymphocytes, per cent	14.0					10.0			12.0						
Large lymphocytes, per cent	5.0					4.0			30.0					2.0	
Eosinophils, per cent	....		.....	.....		....	.....		0.5						
Basophils, per cent	0.5													1.0	
Neutrophilic myelocytes, per cent	2.0		2.5	.....		....	.....		4.0	....		.....		0.5	
Metamyelocytes, per cent	2.0														
Normoblasts	11		.....	.....		9	.....		5	....		.....		2	
Anisocytosis	Moderate					Moderate			Moderate					Moderate	
Poikilocytosis	Moderate					Moderate			Moderate					Moderate	
Polychromatophilia	Moderate					Moderate			Moderate					Moderate	

able by the use of radium temporarily to reduce the leukocytes from several hundred thousand to less than 5000. Several of these splenectomized patients have now lived more than five years following operation, all have shown temporary marked improvement, and were made much more comfortable. The expectation of permanent cure of leukemia by splenectomy is slight, but the operation has a field of usefulness in selected cases.

CONCLUSIONS

We know little concerning the pathology of the spleen, but the pathologic conditions found in the spleen are obviously closely related to the pathology of the blood. In about 270 splenectomized patients we have one group of about 12 whom we were wholly unable to classify, even temporarily. It is best at this time to regard the spleen as little known territory, through which very few trails have been blazed, and to acknowledge our uncertainties in order that we may be more keen in interpreting old facts and gathering new ones.

CLINIC OF DR. HARRY H. BOWING

HODGKIN'S DISEASE TREATED BY RADIUM AND THE *x*-RAY: REPORT OF 4 CASES

CASE I (A87,394).—Mrs. W. A. B., aged forty years, came to the Clinic July 8, 1913 because of stomach trouble and constipation, which had always required physics and enemas for relief. Bowel movements were painful, with a sensation of tearing and bleeding. She had always had stomach trouble and aching in the epigastrium through to the back, unrelated to food, lasting for from thirty minutes to twelve hours, without nausea or vomiting.

Physical examination was practically negative, with the exception that the right kidney was palpable; the lower pole of the left kidney was palpable. A blood count revealed hemoglobin 90 per cent. and erythrocytes 4,480,000. The gastric examination was negative.

September 9, 1919 the patient returned to the Clinic. She complained of enlarged glands in the right and left supraclavicular and right and left axillary regions. In October, 1918 she had had influenza, tightness in the chest, and a cough, associated with chills and fever, which had persisted. It was more intensive when she was in a reclining position and caused a feeling of pressure in the left chest associated with some pain. Within two weeks after the influenza she had noticed that the glands were enlarged. Her temperature had been 101° F. and she had had night-sweats. Shortness of breath, especially during the last few months, had made talking very difficult at times. The patient had gained slightly in weight, but her strength had been greatly diminished. The lower abdomen was very sore, particularly in walking. The bowels had continued constipated.

Physical examination revealed large discrete glands in the right supraclavicular area and similar glands in the left supraclavicular area, one large gland in the right infraclavicular area, one large gland in the left axilla, and smaller glands in the right axilla. The inguinal glands were very small and palpable. The weight was 106 pounds. The pulse was 118. Systolic blood-pressure for the right arm was 124, diastolic 82; systolic blood-pressure of the left arm was 110, diastolic 60. The temperature was 100° F. Rapid, slight diastolic murmurs were heard at the apex of the heart. An area of dulness was found 7 cm. to the left of the sternum and 5 cm. to the right of the mediastinum. In the left chest the dulness extended from the third rib down anteriorly and lower one-third posteriorly. Breath sounds were increased in areas; above almost a bronchophony. There were practically no râles. Examination of the abdomen was negative. The uterus was in good position and normal in size. The blood count revealed hemoglobin 68 per cent., erythrocytes 4,560,000, leukocytes 15,200, polynuclear neutrophils 90 per cent., small lymphocytes 5.5 per cent., large lymphocytes 4 per cent., and eosinophils 0.5 per cent. A roentgenogram of the chest revealed a mediastinal tumor in the right side, with effusion at the left base. A gland was excised, and the diagnosis of Hodgkin's disease made by the pathologist.

July 28, 1921, 6300 mg. hours radium was delivered to two areas in the left of the cervical region, to three areas in the supraclavicular and axillary regions, and to three areas in the region of the spleen. Three areas on the anterior and posterior chest walls were exposed to deep *x*-ray therapy.

November 5, 1919 the patient returned for observation. She had gained 6 pounds in weight; she had not had night-sweats, but the pain across the upper portion of the abdomen had persisted. She had been very much constipated and had felt nauseated, but seldom vomited. The glands had decreased markedly in size. In a roentgenogram of the chest slight improvement was observed (Fig. 554). A roentgenogram of the teeth revealed periapical infection. The patient was placed on Fowler's solution. Twenty-six hundred milligram hours of radium was delivered to the right and left supraclavicular, right and left cervical, and right and left axillary areas. The anterior chest wall, right and left supraclavicular areas, and right and left inguinal areas were exposed to deep x-ray therapy.

March 5, 1920 the patient returned. Her general condition had continued fair. She tired easily. Her appetite was good and she had not lost in weight. She had had night-sweats during the last month. Dyspnea was less marked. Spitting of blood was attributed to a recent tonsillectomy. The glands had decreased in size, and at times increased temporarily. A roentgenogram of the chest was negative. One thousand milligram hours of radium was delivered to the right cervical area. Deep x-ray therapy was applied to the anterior and posterior chest walls and right and left groins.

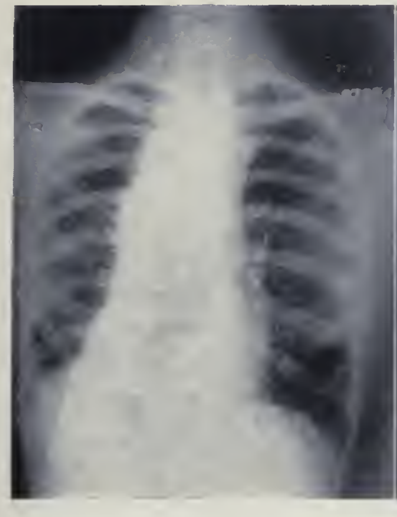

Fig. 554.

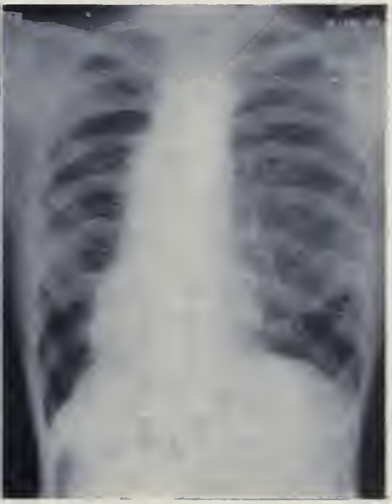

Fig. 555.

Fig. 554.—(Case A87,394.) November 5, 1919. Large mediastinal shadow in Hodgkin's disease.

Fig. 555.—(Case A87,394.) June 18, 1920. Reduction of hilar shadow following intensive deep x-ray therapy to the chest cavity. A negative roentgenogram was obtained.

June 18th, when the patient returned again (Fig. 555), she stated that she "took cold" very easily, and that her heart beat very "rapidly and pounding." She had been doing unusual and hard work. She was without fever. Her appetite was fair and she was holding her weight. She slept poorly. Twenty-five hundred milligram hours of radium was delivered to the right cervical region. Deep *x*-ray therapy was applied as before.

September 15, 1920 the patient returned. She complained of sharp constant pain in the lower abdomen. There was no pain in the chest, but a slight cough. The posterior chain of glands on the right side was slightly enlarged. One thousand milligram hours of radium was delivered to this area and deep *x*-ray therapy was applied as before.

January 12, 1921, when the patient reported for observation, the glands in the right cervical area were considerably larger; otherwise there was no change. Sixteen hundred milligram hours of radium was delivered to the right cervical area and deep *x*-ray therapy was applied as before.

March 21st the patient reported that for the past two weeks she had had a slight cold with a full, tight feeling in the chest, with rapid enlargement of the glands on the right side of the neck and under both arms. At the time of examination this had subsided considerably. The cough was much better; it was not productive. Physical examination revealed some enlargement of the glands in the right and left supraclavicular regions, right submaxillary and cervical regions, and right and left axillas. Thirty-seven hundred milligram hours of radium was applied to the involved area and deep *x*-ray therapy was applied to the anterior abdominal wall, the back, and the right and left axillas.

April 12th the superficial glands were markedly reduced in size and the patient felt much stronger. She had not gained in weight, but she looked improved. The glands in the neck and axilla had decreased in size. Deep *x*-ray therapy was applied to the anterior and posterior chest walls, to the abdomen, and to the back.

Case II (A317,905).—Mrs. G. G., aged twenty-eight years, came to the Clinic June 1, 1920 on account of multiple tumors of the head and neck. A small painless lump had been noticed first in the submental region eleven years before. Local applications had been made without effect. About one year later the tumor, reported to be "about the size of a hen's egg," had been excised. Shortly afterward similar lumps had appeared in the left submaxillary and cervical regions; these had been excised four and a half years later. Rapidly growing nodules in the left posterior cervical region had been noticed soon after the operation and excised about two and a half years before examination. The nodules, the patient stated, varied in size "from a pea to a hen's egg." Since then lumps had appeared in the right submaxillary and cervical regions and in the scalp, and lumps had recurred around the old incisions. From September to December, 1919 forty x-ray treatments and about twenty short radium treatments had been given, with much improvement. The patient's face, the eyelids especially, had been swollen continuously since the birth of her sixth child in August, 1919. Her feet were also markedly swollen. In December a mass in front

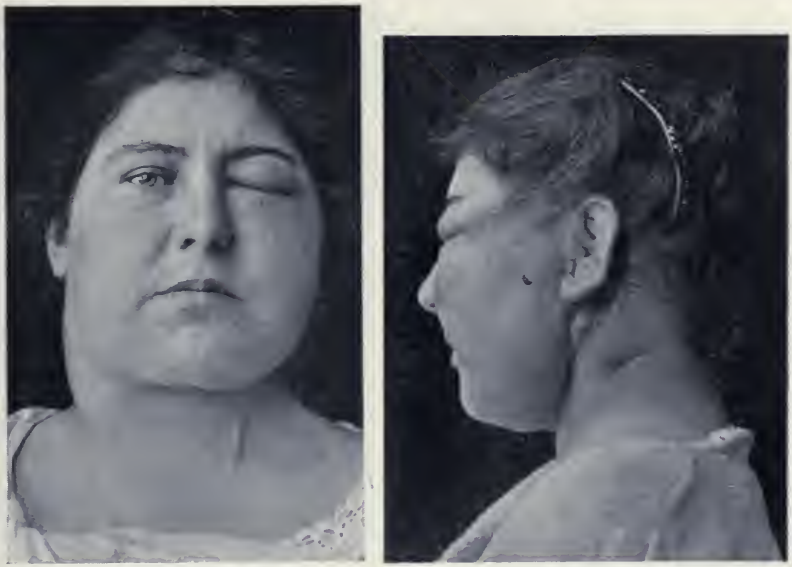

Fig. 556. Fig. 557.

Figs. 556, 557.—(Case A317,905.) June 1, 1920. Hodgkin's disease. Marked distortion of features due to recurring glandular enlargements following many attempts at surgical removal. Marked edema of left half of face.

of the left ear and one posterior to the ear had ruptured and discharged. She had some pain in the chest at times and a slight cough.

The patient was well nourished and weighed 150 pounds. Marked swelling of the cervical glands on the right side of the neck extended from the base of the ear to the clavicle (Figs. 556, 557). A gland was removed for diagnosis; the pathologist's report was Hodgkin's disease. Examination of the urine revealed specific gravity of 1.018, acid reaction, and albumin Grade 1 on a scale of 1, 2, 3, 4. Hemoglobin in the blood was 67 per cent.; the erythrocytes were 4,000,000, the leukocytes 5600, polynuclear neutrophils 48.5 per cent.; small lymphocytes 36.5 per cent., large lymphocytes 13.5 per cent., eosinophils 1 per cent., and basophils 0.5 per cent. Examination of the sputum

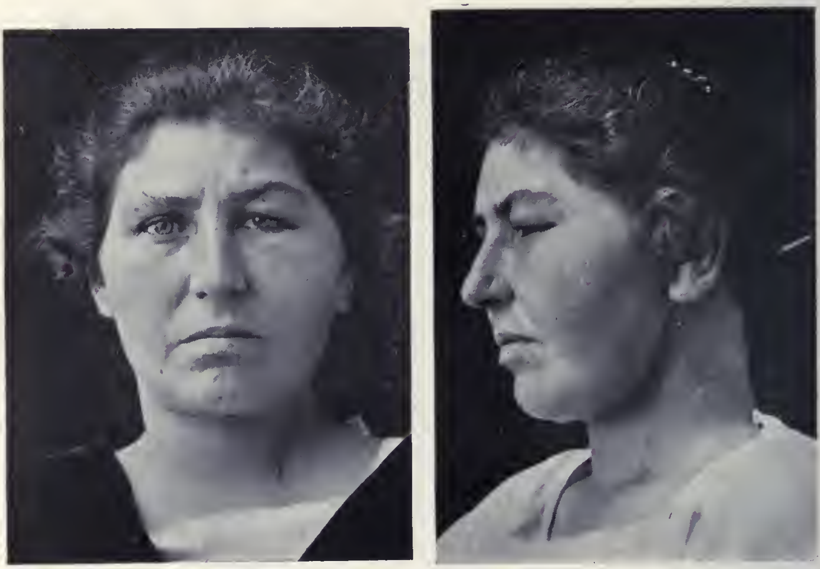

Fig. 558. Fig. 559.

Figs. 558, 559.—(Case A317,905.) September 1, 1920. Hodgkin's disease. Marked reduction in glandular enlargement. The scars are responsible for incomplete absorption of edema. The improvement followed exposure to intensive radium treatment.

and a roentgenogram of the chest were negative. The Wassermann reaction on the blood was negative.

July 5, 1920 ninety-seven hundred milligram hours of radium was delivered to the right and left cervical areas.

September 1st the patient returned for observation. The condition of the jaw and neck was markedly improved (Figs. 558, 559). The swelling had subsided almost completely in the left cheek; it was slight around the left eye. The glands had reduced at least 80 per cent. The menstrual periods had been absent for four months, the uterus was the size of a four month's pregnancy. Thirty-seven hundred milligram hours of radium was delivered to the left cervical area.

November 8th the patient returned in good general condition. She had had some cough during the last few weeks, but she attributed this to a "cold." The glands on the side of the neck had been increasing in size again, she thought. Her general condition was about the same, with a slight increase in the glandular enlargement which was confined to the cervical areas. The pregnancy was progressing and seemed uneventful. Twenty-nine hundred milligram hours of radium was applied to the left cervical areas.

CASE III (A327,080).—Miss I. H., aged twenty-two years, came to the Clinic July 29, 1920. Since May the patient had had three distinct types of pain in the lower portion of the back; pain on the right, pain on the left, and pain beginning in the left lower back and radiating to the abdomen. At times the pain had radiated to the chest. The pain had come on in definite attacks, usually at midnight, and lasted until 4 A. M. It was knife-like in character and did not radiate along lines of the ureter. Deep breathing did not influence it and she was entirely free from it during the day. Relief was best obtained when she sat up and applied heat. Each attack had lasted two weeks. There had been no fever. There were no gastric symptoms. Enlargement of the glands in the neck had been noticed one month before examination. Since November, 1919 she had had a chronic cough, shallow and productive, which began with a slight cold, and had persisted with periods of improvement. She had not had night-sweats or fever. She had lost 16 pounds in weight since May. Her appetite had been good except during the spells of pain.

Physical examination revealed a well-nourished young adult with many glandular enlargements, chiefly in the left supraclavicular area, measuring 0.8 to 1 cm. in diameter, one gland in the right supraclavicular area 1 cm. in diameter, and several glands in the left axilla, the largest 2 cm. in diameter. The anterior pillar of the fauces on the left was reddened. The size of the tonsils was graded 2 on the basis of 1, 2, 3, 4, with plugs. The teeth were in very good condition. The thyroid was slightly enlarged uniformly. Moist and persistent râles were heard over the apex of the lower right lobe posteriorly. The spleen was not palpable. The urine was acid in reaction and contained albumin 1. The hemoglobin in the blood was 59 per cent.; the erythrocytes were 3,820,000, the leukocytes 11,200, polynuclear neutrophils 81 per cent., small lymphocytes 11.5 per cent., large lymphocytes 6.5 per cent., eosinophils 0.5 per cent., basophils 0.5 per cent., and slight poikilocytosis. The sputum was negative for *Bacillus tuberculosis.* The Wassermann reaction on the blood was negative. A combined phenolsulphonephthalein test gave a return of 60 per cent. in two hours and fifteen minutes. Roentgenograms of the chest revealed enlarged glands and irregular consolidation of the lung in the middle right lobe (Fig. 560). Roentgenograms of the kidney, ureter, and bladder were negative. A gland was removed for diagnosis; the pathologist's report was Hodgkin's disease. Tonsillectomy and radium treatments were recommended.

August 4th thirty-six hundred and fifty milligram hours of radium was given. Three areas were exposed in the right and left supraclavicular and right axillary areas.

September 1st the patient returned to the Clinic for observation. Her condition was about the same. A slight cold contraindicated tonsillectomy. It was not deemed advisable to treat with radium at this time. A roentgenogram of the lungs showed no change.

September 22d the patient returned for tonsillectomy.

September 27th very little change was noticed in the size of the enlarged gland; fifty-six hundred milligram hours of radium was applied to the left cervical areas.

December 6th, when the patient returned for observation, her strength was about the same and she had not lost in weight. The attacks of backache had remained unchanged; aspirin gave relief. The cough persisted, although it was not so productive. The supraclavicular glands were not noticeable. The left axillary glands had remained about the same in size. Twenty-three hundred milligram hours of radium was delivered to the right and left supraclavicular areas and to the left axilla. Deep x-ray therapy was given to the anterior and posterior chest walls.

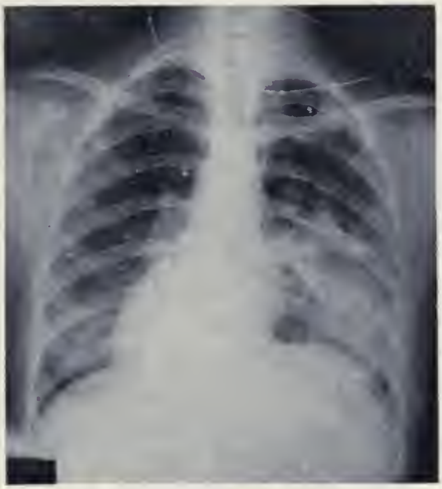

Fig. 560.—(Case A327,080.) Hodgkin's disease. Chronic cough questionably due to mediastinal enlargements, although the slight glandular enlargements revealed in the roentgenogram are hardly sufficient to account for the cough. The consolidation in the middle right lobe, probably an abscess, which was not proved clinically, in all likelihood is responsible for the cough.

March 7, 1921 the patient returned. Her complaints were about the same except that she had discovered an enlarged gland in the right groin. Recently the feet and legs had been itching, with a sensation of heat. Menstruation was normal. Her appetite was fairly good, but she had been losing some weight. In January, while at home, she had had *x*-ray treatments over the chest and back. The glands in the neck seemed to be normal in size. A few glands in the axilla were palpable and a large hard gland in the right groin. The urine was acid in reaction, specific gravity 1.030, and albumin 0. The hemoglobin in the blood was 62 per cent.; the erythrocytes were 3,820,000, and leukocytes 7600. Roentgenograms of the kidney, ureters, and bladder were negative. Roentgenograms of the chest revealed an abscess at the right base of the middle right lobe with multiple small cavities, probably bronchiectasis. March 10th fourteen hundred milligram hours of radium was applied to the left axilla and right groin. Deep *x*-ray therapy was applied to the anterior and posterior body surface.

April 13th, when the patient returned for further observation, she reported that she had had no pain for the past two weeks. Her weight was 113 pounds. The gland in the right groin was smaller. The cough was about the same. She felt improved and was without the tired feeling. On physical examination the chest was found to be negative; it was not examined by the Roentgen ray at this time. Radium treatment did not seem advisable. Intensive *x*-ray treatments were given to the anterior and posterior body surfaces.

Case IV (A319,178).—Miss J. P., aged twenty-seven years, came to the Clinic June 9, 1920 complaining of enlarged glands of the neck, weakness, nervousness, and cough. She had not felt well since having influenza in December 1918. The cough, which was fairly productive, had developed six months before. She had felt weak, slept poorly, and her appetite had been poor. She had had fever (99° to 101° F.), which had seemed to be worse in the afternoon, and a rapid heart. She had not had night-sweats. She had lost 20 pounds in weight since October, 1919, when she first noticed the enlargement of the glands in the neck, which had progressed, fluctuating somewhat in size, but without pain. For the last two years her skin had flushed easily, particularly on exercising or in a warm room. At times she had had intense itching of the skin. There had been no gastric or urinary symptoms.

The patient did not look well. Her weight (125 pounds) was 25 pounds below normal. The systolic blood-pressure was 105, the diastolic 80, the pulse 105, and the temperature 99.6° F. The glands in the right side of the neck, a small gland in the right supraclavicular space, two small superficial glands in the left posterior cervical region, and one small gland in the right supraclavicular region were enlarged. Chest expansion was diminished, although not sufficiently to suggest diseased lungs. The specific gravity of the urine, alkaline in reaction, was 1.015. The hemoglobin was 68 per cent.; the erythrocytes were 3,550,000, the leukocytes 4000.

June 22d the posterior triangle of the left side of the neck was dissected completely. The pathologist's report on the gland removed was Hodgkin's disease. Deep x-ray therapy was applied to the right and left supraclavicular and right and left cervical glands.

July 21st the patient returned. The field of operation was densely infiltrated and it was difficult to determine the real nature of the infiltration; it might have been due to the operation alone. The enlargement of the gland in the right supraclavicular area had disappeared. Thirty-six hundred milligram hours of radium was delivered to the left supraclavicular region and deep x-ray therapy was applied to the right and left supraclavicular and right and left cervical glands.

September 29th the patient returned, with a gain in weight of 6 pounds. She had recovered from her operation. Her face had itched and burned at times, increasing when she was restless from overwork. She was without pain and, as a rule, she slept well. She believed that she coughed less than before. She still was easily fatigued, but her appetitie was good, and she did not believe that she had had fever. Her weight was 135 pounds, the pulse 72, and temperature 98.6° F. The glands in the supraclavicular region on the right side were enlarged. A roentgenogram of the chest was negative (Fig. 561). Sepsis in the tonsils was graded 3.

October 9th tonsillectomy was performed.

May 11, 1921 the patient revisited the Clinic, complaining of cough which three weeks before had increased suddenly, and had become very distressing during the day and much worse during the night; it was slightly productive. For the last eighteen or twenty days she had been able to sleep only propped up in bed, and then with very little relief. She had a slight fever for the last week or two. Pruritus had been intense for the last six or eight months. Dyspnea had been present for three weeks, and had made breathing at times almost impossible during the last five days. For two years the feet had swelled somewhat on exertion. She had had a poor appetite for three weeks and had slept poorly. She did not have severe headaches, but for

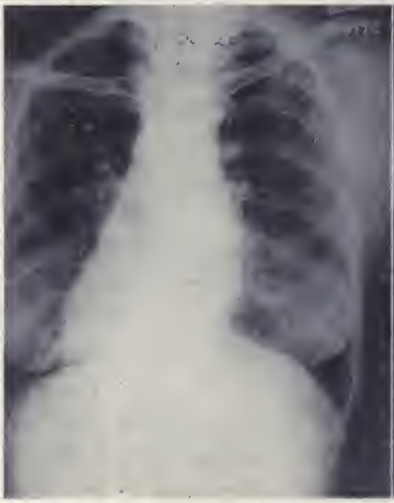

Fig. 561.

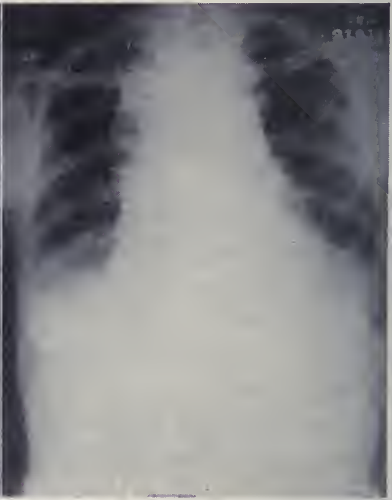

Fig. 562.

Fig. 561.—(Case A293,198.) September 30, 1920. Hodgkin' disease. Roentgenogram reported to be negative. *x*-Ray therapy to the chest was not given routinely in the Clinic at this time.

Fig. 562.—(Case A293,198.) May 11, 1921. Hodgkin's disease. Roentgenogram shows large mediastinal shadow with fluid at both bases. As a routine in all cases of Hodgkin's disease the thoracic and abdominal cavities are exposed to deep *x*-ray therapy.

years she had had a dull heavy feeling in the frontal area. Her weight was 129.5 pounds; pulse 96, temperature 99.8° F. The urine was acid in reaction and contained albumin 1. The hemoglobin was 62 per cent.; the erythrocytes were 4,110,000, leukocytes 7400, lymphocytes 12.5 per cent., large mononuclears 2.5 per cent., basophils 0.5 per cent., and neutrophils 84.5 per cent. A roentgenogram of the chest revealed a bilateral mediastinal mass with fluid at both bases (Fig. 562). Physical examination revealed enlargement of the right cervical glands and activity in the left cervical area, marked bronchial pressure, and difficult expiration and inspiration. Intensive x-ray treatments were given. The right and left supraclavicular areas, anterior and posterior chest walls, inguinal glands, and back were exposed to deep x-ray therapy. The patient was instructed to return in three weeks for further observation.

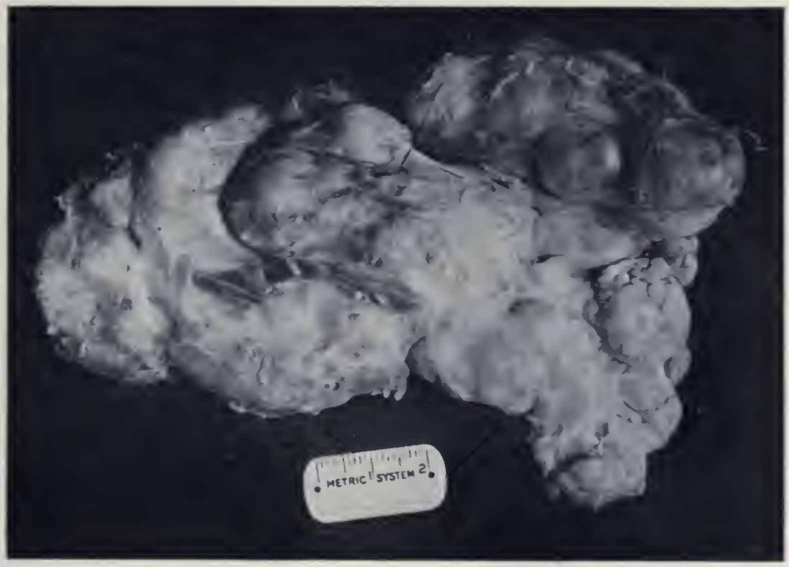

Fig. 563.—Gross specimen from the cervical glands removed surgically from a patient with Hodgkin's disease. The nodes are shown intimately bound together by fibrous tissue.

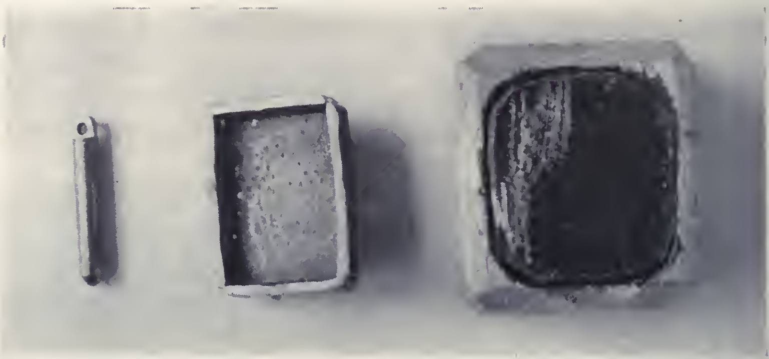

Fig. 564.—Universal tube applicator. Balza wood block, 2.5 by 3 by 4 cm. Lead filter 2 mm. thick.

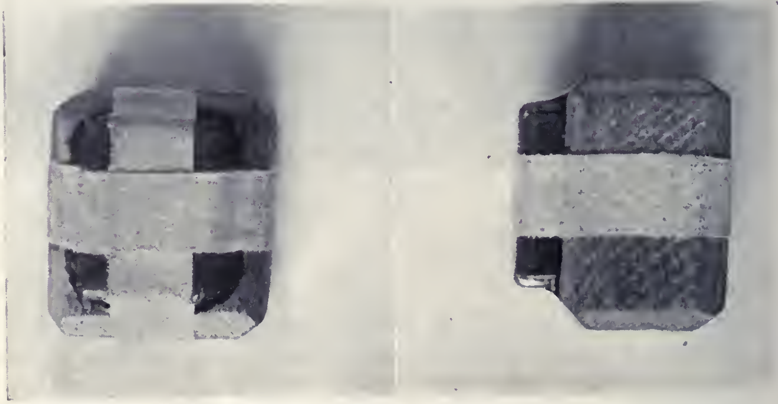

Fig. 565.—Universal tube applicator. Balza wood block and lead filter assembled for application.

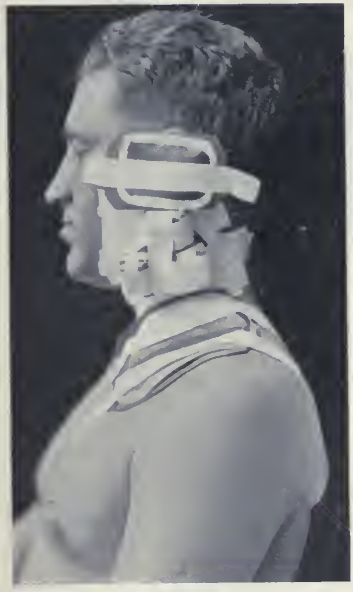

Fig. 566.—Block applicators strapped in position with adhesive plaster. Lead disks, 1 mm. thick, rubber sheet, 2 mm. thick, fixed in position to protect the adjacent skin surface from the primary and secondary soft irradiations which are usually responsible for the distressing erythema.

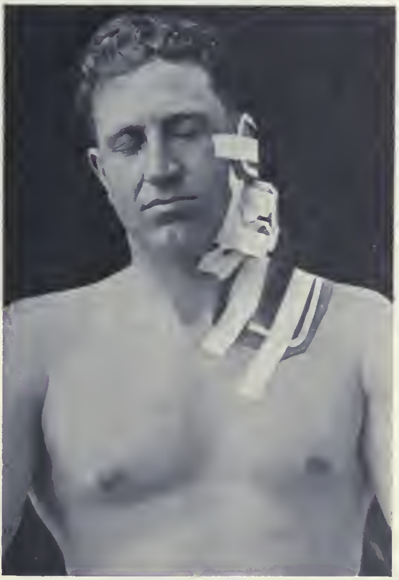

Fig. 567.—Front view of patient with block applicators in place as shown in Fig. 566.

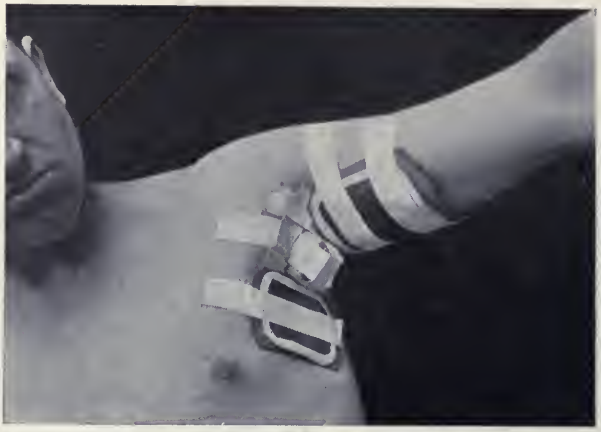

Fig. 568.—Block applicator fixed to irradiate the axillary glandular enlargements, with protectors in place. During application the arm is maintained at a right angle.

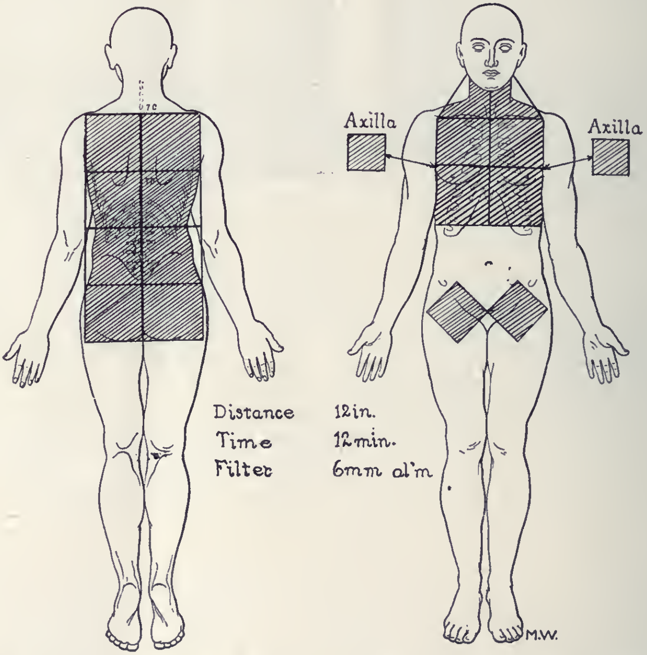

Fig. 569.—Areas exposed to deep *x*-ray therapy for Hodgkin's disease.

TREATMENT OF BRAIN TUMORS

ALFRED W. ADSON

THE treatment of brain tumors depends on the type and position of the tumor and on the effects of the pressure it produces. Not infrequently patients present themselves at the Mayo Clinic on whom decompressions have been performed for lesions other than those due to intracranial pressure, and blind and moribund patients suffering from inoperable lesions are brought for consultation. Such deplorable conditions are due, no doubt, to improper examination and diagnosis. Patients suffering from a group of neurologic symptoms should be carefully examined and properly advised by a competent neurologist and not be kept on potassium iodid as so often is done. Too many physicians feel that nothing can be accomplished if the condition is brain tumor, and they do not, therefore, have neurologic examinations made or encourage consultation with a neurologic surgeon. Other physicians believe that decompression is all that can be done for such patients and that an attempt to remove the tumor radically is not warranted.

The field of neurologic surgery is slowly developing and, I believe, in time the neurologist and the neurologic surgeon will be able, after examination, to state whether or not a patient has an operable lesion, and that more radical operations will be performed and fewer simple decompressions.

PATHOLOGY

Clinically, brain tumors fall into two groups—cortical and subcortical, or operable and inoperable. The terms are not exactly synonymous, since some cortical tumors are inoperable and some subcortical tumors are operable. Another classification which might be made is encapsulated tumors and nonencapsulated tumors of the diffuse infiltrating type, or tumors whose situation permits removal without destruction to the brain, and tumors whose situation makes removal hazardous. The greater percentage of operable tumors are endotheliomas; of inoperable tumors, gliomas and metastatic lesions. Endotheliomas include variations, such as neurofibromas and psammomas, while gliomas include hemangiogliomas, gliosarcomas, gliopsammomas, and so forth.

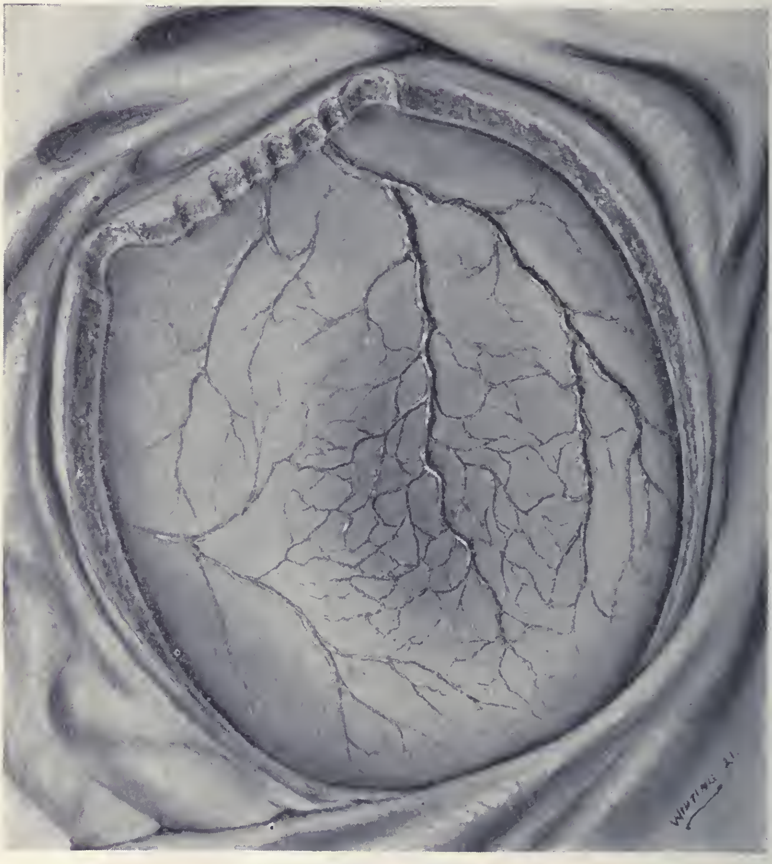

Fig. 570.—(Case A314,564.) Venous engorgement over subdural endothelioma.

Endotheliomas arise from the endothelial tissue of the meninges and the large sinuses, the most common arising from the meninges. They appear most often over the cerebrum and are equally distributed over the frontal, temporal, and occipital lobes; they produce symptoms by pressure rather than by invasion; they originate from endothelial tissue and grow into the brain substance through the course of least resistance, and not infrequently, after the area of dura involved is resected, the tumor can be enucleated easily without destruction of the surrounding tissue by gently dissecting off the brain. Occasionally, cortical vessels on the brain communicate with the tumor; if it is removed intact without breaking the membrane and, if removed with the dura or sinus on which the tumor has arisen, no recurrence will take place (Figs. 570–572).

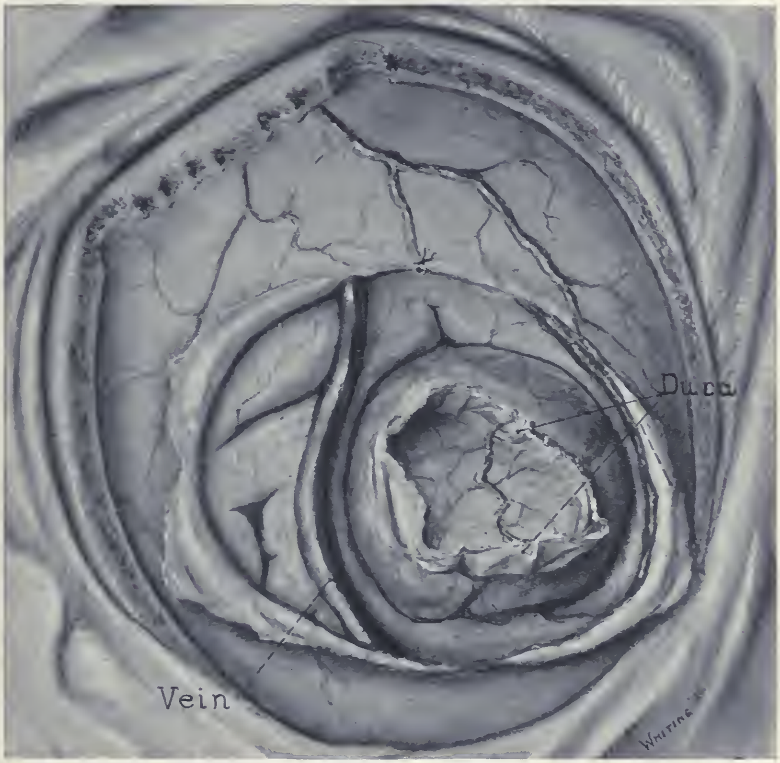

Fig. 571.—(Case A314,564.) Encapsulated tumor with dura attached.

Endotheliomas vary in size, depending on the duration of growth. If the lesion is operated on when the first symptoms are manifest, it is usually from 3 to 7 cm. in diameter, quite rounded, of a reddish tinge, and irregular, presenting several centers of growth. The capsule is fairly thin, but definitely covers the cellular growth. The tumor itself is moderately hard and the edges are well defined when sectioned; it rarely becomes necrotic at the center (Figs. 573–576).

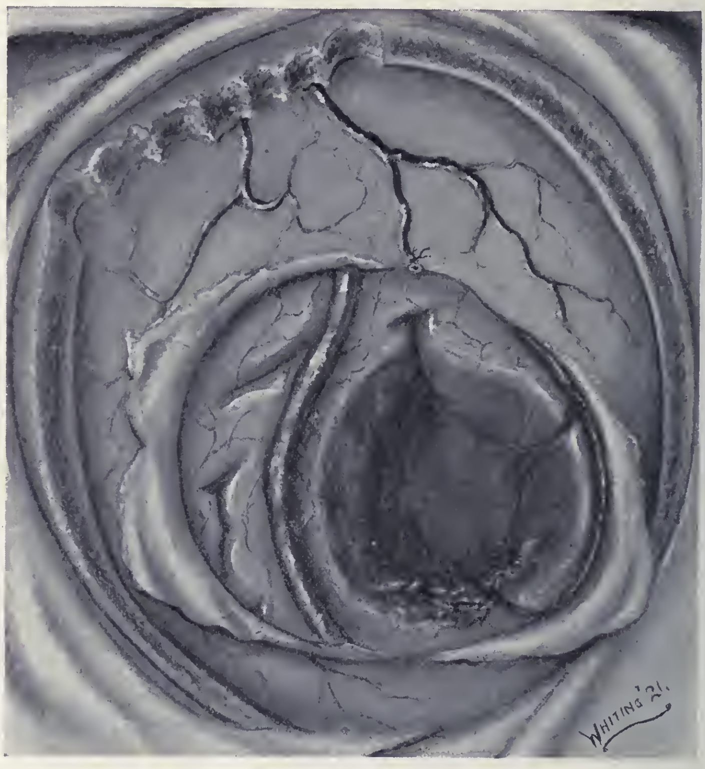

Fig. 572.—(Case A314,564.) Smooth bed of the tumor, showing the convolutions of the motor area pushed aside. The patient recovered completely.

Perisagittal endotheliomas produce sufficient irritation and develop sufficient blood-supply to produce a thickening in the skull, so that an irregularity is visible and the enlargement of the skull presents itself as a rounded osteoma-like knob. The thickened areas of bone along the longitudinal sinus are fairly diagnostic of an underlying endothelioma, even though intracranial symptoms may not have appeared.

Intracranial neurofibromas occur most often as acousticus tumors, either single or with general involvement of the peripheral nerves. They vary in size from 1 to 4 cm.; if operated on early they resemble endotheliomas; if degeneration has occurred they break easily, have a yellowish-pink appearance, and the membranes correspond to the covering of the acousticus nerve.

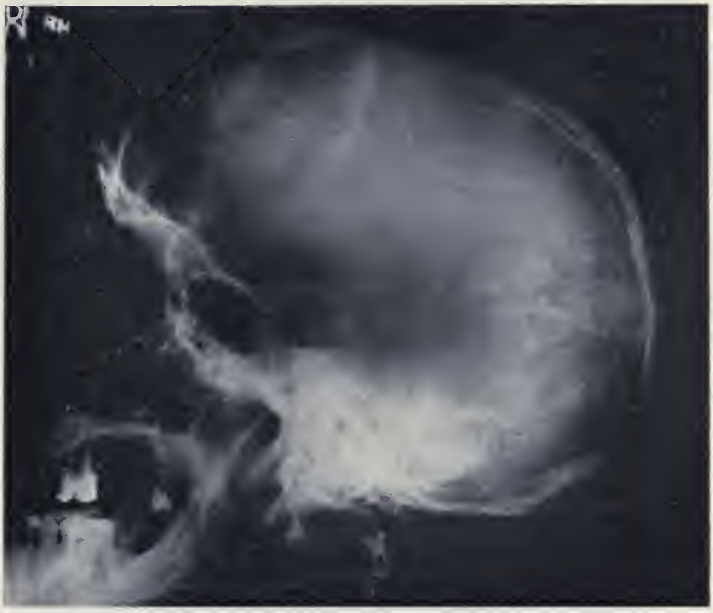

Fig. 573.—(Case A344,171.) Roentgenogram (December 29, 1920) showing a subcortical calcified endothelioma in the right occipital lobe.

Suprachiasmal endotheliomas are very rare; they occur underneath the frontal lobe, arising from the meninges and varying in size; as a rule they are about the same size as neurofibromas and present about the same color and consistency.

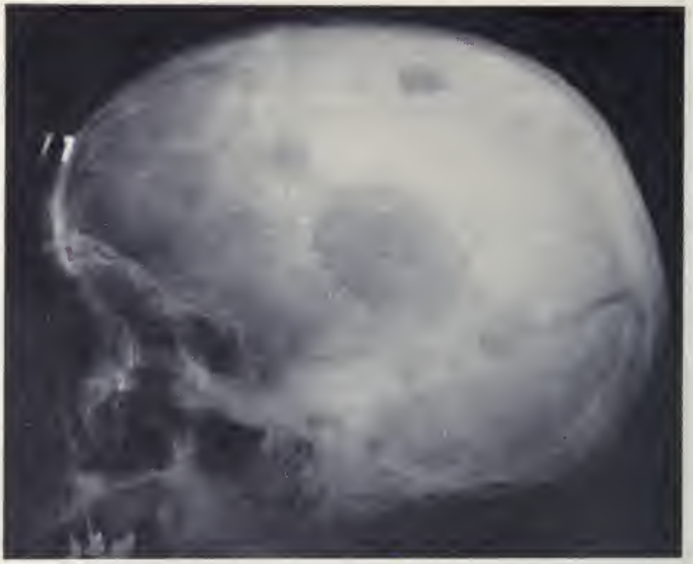

Fig. 574.—(Case 344,171.) Roentgenogram (January 22, 1921) after removal of endothelioma.

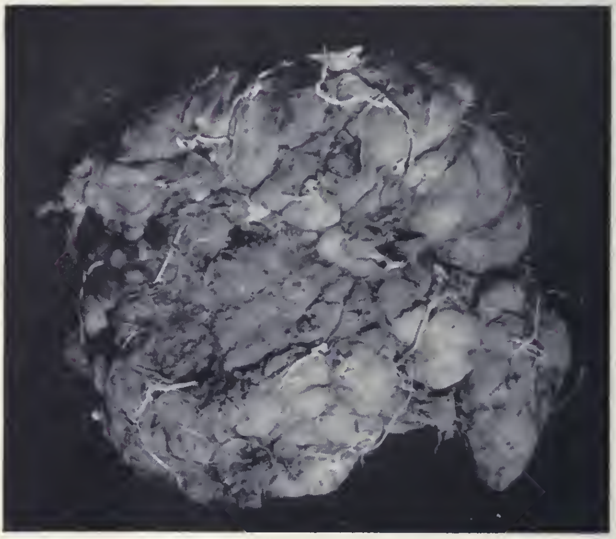

Fig. 575.—(Case A344,171.) Dark red, nodular, definitely encapsulated endothelioma situated about 1 cm. beneath the surface of the cortex, extending almost to the corpus callosum. The tumor weighed 85 gm.

Gliomas are far more common than any other type of brain tumor. They may be situated cortically or subcortically. If they are cortical they are purplish red and of about the consistency of the brain; they have no limiting membrane, and consequently it is very difficult to determine the distance they have infiltrated the brain. If they are situated subcortically they resemble the cortical lesions, but occasionally they degenerate at the center, and when explored yield quantities of yellow, ropey, gelatinous material. The destruction is probably due to the insufficient blood-supply. Numerous tumors of this kind have been known to degenerate completely, recovery finally taking place.

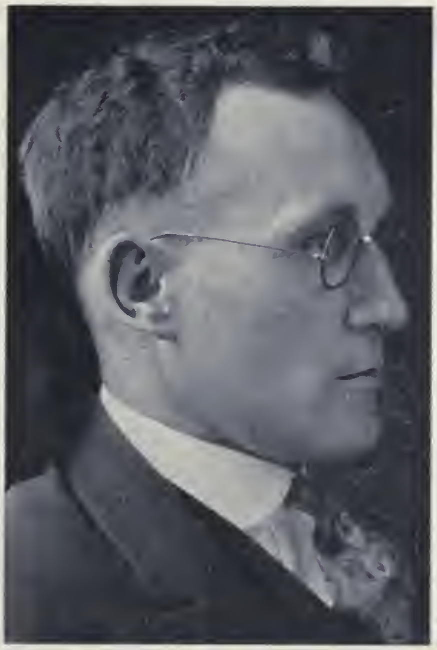

Fig. 576.—(Case 344,171.) Patient four months after removal of endothelioma shown in Fig. 575.

Sometimes these tumors take on malignant changes and other variations.

Metastatic growths are usually multiple carcinomas or sarcomas; these growths are situated both cortically and subcortically, and have the characteristic appearance of the primary growth.

The type of pituitary tumor produced depends on the tissue from which it arises. Strumas, adenomas, and carcinomas develop from the entoderm which makes up the anterior lobe; gliomas and sarcomas arise from the posterior lobe coming from the glial tissues; and cysts as well as benign and malignant tumors arise from the pars intermedia, which is composed of both entoderm and glial tissue.

Tumors of the gasserian ganglion are usually endothelial in type; they rarely become very large and cause localizing symptoms before general symptoms.

Tuberculomas and gummas are not true brain tumors, but the symptoms they cause simulate those of brain tumor, hence they must always be borne in mind when a diagnosis is being made. While they are prone to occur more often in children, they may occur in adults. They are both single and multiple; they occur more often in the cerebellum than in the cerebrum, and may or may not be associated with tuberculous meningitis.

On examination of the mass *in situ* it is difficult to determine whether or not it is tuberculomatous, but it can be differentiated when exposed, since a tuberculoma is usually situated subcortically, is very hard, and has no nodular, definite capsule. It is not uncommon to find strings of nodules leading away from the principal mass along the blood-vessels.

SYMPTOMATOLOGY

It would be quite impossible to collect all of the different groups and combinations of symptoms that manifest themselves with brain tumor. I shall, therefore, review only some of the more practical points in the symptomatology.

Headache is one of the early and pronounced symptoms. It comes on intermittently, is fairly mild at the onset, but continues to progress until it is extremely severe; it usually occurs independent of any indiscretion in diet, and at any time of the day, but is more prone to occur in the morning. The pain is sometimes described as a dull ache, and sometimes as a bursting pain in any part of the head.

Vomiting is usually the second symptom. It is referred to as projectile in type, and is brought on without relation to food; it occurs at any time during the day or night, regardless of whether the stomach is full or empty. It is liable to occur when the headache is most severe, and is manifested by a sudden violent expulsion of gastric contents for several feet.

Visual disturbance is, as a rule, the next symptom; occasionally other localizing symptoms precede it. When the lesion is situated in a silent area of the brain or in a subcortical position, visual disturbance is the third symptom to manifest itself. The patient complains of haziness, until a fog, as he describes it, blots out the vision; this is due to papillo-edema, which continues until the vision is destroyed by secondary optic atrophy. The papillo-edema is spoken of as choked disk, and is read by an ophthalmoscope in diopters. It is not uncommon for an inexperienced ophthalmologist to consider the papillo-edema an inflammatory process or to refer to it as some form of bulboretinitis and attribute its cause to sinus infection. Not infrequently, through a lack of familiarity with intracranial neoplasms, a secondary atrophy is allowed to develop before decompression is performed.

Pain and local tenderness may occasionally indicate the site of the neoplasm, but are not pathognomonic signs. Patients suffering from cerebellar lesions often complain of pain and tenderness over the occiput and in the muscles of the neck, and of tender areas painful on palpation, which are at times significant if the sensitiveness is located over the frontal or parietal area of the skull.

DIFFERENTIAL DIAGNOSIS

Headache, vomiting, and choked disks are symptoms of intracranial pressure and are usually due to intracranial neoplasms, or inflammatory processes producing cerebral edema, or serous meningitis. Before a diagnosis of brain tumor is made it is quite necessary, therefore, to eliminate the possibility of acute meningitis of an epidemic type, or localized pyogenic meningitis, encephalitis, or chronic meningitis due to *Bacillus tuberculosis* or syphilis. The history is of great value in this connection. If the trouble has been present for several months usually the possibility of acute infection can be ruled out. If there is any doubt, a spinal puncture may be made unless a choked disk of more than 3 diopters is present or if there is marked evidence of an infratentorial lesion manifested by cerebellar inco-ordination. The spinal puncture will reveal the presence of any acute infection. The normal cerebrospinal fluid is clear, with a negative Nonne, a cell count below 7.

If the patient has epidemic meningitis the spinal fluid will be cloudy, containing many pus-cells, a few of which probably include the meningococcus, and the cell count will be high. If the meningitis is caused by a pus-forming organism the findings will be the same; the organism, however, will be different.

Chronic meningitis may continue for several months, in which case the history is of value in determining the onset of the trouble, the possibility of tuberculous or syphilitic lesions elsewhere in the body, and of syphilis of the central nervous system.

Patients with tuberculous meningitis rarely recover, thus prolonged symptoms usually preclude the diagnosis of tuberculous meningitis. Tuberculoma of the brain with localized circumscribed meningitis exists at times for months and cannot be differentiated from brain tumor. Syphilitic meningitis is confusing, since, if there are no symptoms referable to the central nervous system such as are manifested in tabes dorsalis or in general paresis, the intracranial pressure simulates brain tumor. Again the spinal puncture is of value since there is usually a positive Wassermann reaction, increased cell count, positive Nonne, and second zone Lange. The spinal fluid in patients suffering from tuberculous meningitis is clear, with increased lymphocytes, a positive Nonne, and active tuberculosis bacilli. If bacilli cannot be demonstrated in the stain, a guinea-pig inoculation test may be necessary.

Encephalitis sometimes presents very confusing symptoms.

This is particularly true since the prevalence of influenza. The spinal fluid occasionally gives evidence of chronic inflammation in an increased cell count and a positive Nonne. The fluid itself is usually clear, but the swelling of the optic nerve head rarely becomes so marked in encephalitis as in brain tumors.

The possibility of brain abscess must also be considered before a diagnosis of brain tumor is made, inasmuch as brain abscess is preceded by encephalitis, and while developing simulates brain tumor. A brain abscess passes through three stages —the initiatory, the quiescent, and the terminal. During the initiatory stage the onset of the infection is associated with encephalitis, resulting in a diffuse encephalitis and death, or in a circumscribed encephalitis, with softening and pus formation. In many instances the disease passes into the quiescent stage with little trouble except for symptoms of intracranial pressure, which are difficult to distinguish from those produced by brain tumor. In the third stage the abscess is either absorbed and the tissues heal, which is very rare, or there is a rupture of the abscess into the ventricle which produces diffuse encephalitis, basal meningitis, and death.

Two laboratory procedures have been employed in an attempt to determine the presence of brain tumor; one is the Abderhalden test, which has not been very generally accepted, the other ventriculography. The latter procedure has been of distinct value in some cases, but it cannot be practised indiscriminately since it is not unattended with surgical risk. Further study is necessary in order to carry out the purpose of the test, which is to localize an operable tumor when neurologic diagnostic means have failed.

After the possibility of a diagnosis of an inflammatory process has been eliminated it must be inferred that the symptoms of intracranial pressure are due to a neoplasm. A tumor around the brain stem or in the cerebellum where it obstructs the outward flow of cerebral fluid through the aqueduct or the foramina of Magendie or Luschka, need not be very large to cause exaggerated symptoms. On the other hand, a tumor in the frontal, temporal, or occipital lobes may grow to 9 cm. in diameter without producing choked disks and be associated with only mild headache and little or no vomiting. It is also true that tumors situated subcortically in the cerebrum are more liable to produce the three cardinal symptoms of intracranial pressure (headache, choked disk, and vomiting, followed by paralysis) than those situated on the cortex, which more often produce localizing symptoms in the form of motor or sensory Jacksonian convulsions, with headache and localized tenderness, but less vomiting and less swelling of the optic nerve head.

After the diagnosis of intracranial neoplasm has been made by a process of elimination symptoms of localization should be looked for. The gross anatomy of the brain should be borne in mind, especially the centers controlling certain parts of the body: the precentral motor convolution with its various divisions; the postcentral sensory area; the speech center in the island of Reil or Broca's area; the center of asteriognosis in the superior temporal convolution on the left side; the optic center in the occipital lobe; the center of smell and taste in the uncinate and hippocampal gyri; the centers of cerebration in the frontal convolution; the nuclei with the various cranial nerves in the brain stem; the courses and the exit of the various cranial nerves with their relation to the skull; the significance of the semicircular canal and its relation to the cerebellum through the acousticus nerve, and the level of the different decussations of the motor and sensory pathways.

In a large percentage of brain tumors of short duration there are no definite localizing symptoms, and this type of tumor is badly treated since it is neglected until secondary optic atrophy has developed. Patients should be given thorough neurologic examinations since mild localizing symptoms may be elicited besides those of intracranial pressure, such as disturbance of a reflex, slight weakness in a cranial nerve, or sufficient tenderness to indicate localization of the neoplasm and warrant exploration in conjunction with the decompression. If symptoms of paralysis, Jacksonian convulsions, hemianopsias, either homonymous or bilateral, if gustatory or olfactory disturbances and aphasias are present, the brain tumor may be definitely located.

A certain group of patients develops grand mal convulsions in conjunction with the symptoms of intracranial pressure without localizing signs. Such convulsions do not enlighten the examiner appreciably, but they emphasize the presence of a lesion, producing either direct or indirect pressure on the temporosphenoidal lobe, which is probably subcortical.

Unlocalized tumors are usually found in the silent area of the brain; the frontal and temporal lobes and the postcentral region above the optic radiation are most often involved.

Tumors of the cerebellum rarely develop without marked symptoms. Inco-ordination and symptoms of intracranial pressure are the first manifestations; these are followed by pronounced disturbance on one side or the other of the body associated with involvement of the cranial nerves. In the classic acoustic syndrome the symptoms are tinnitus aurium, beginning deafness with symptoms of intracranial pressure, complete deafness, weakness in the seventh nerve, and, if the growth is permitted to continue, cerebellar ataxias and involvement of the cranial nerves having their exit in the vicinity of the internal auditory meatus. Tumors of the vermis or from the roof of the fourth ventricle give symptoms of cerebellar disturbances with few, if any, additional localizing signs.

Pituitary tumors produce hemianopsias, metabolic disturbance in the form of gigantism, and adiposis genitalis, acromeglia, and dyspituitarism.

Tumors of the gasserian ganglion usually cause pain followed by anesthesia. As the tumor grows it extends mesially and posteriorly, and involves the cranial nerves in that vicinity, usually the sixth, the fourth, and the third. Basal tumors invading the skull through the foramina cause localizing symptoms and result in paralysis of the nerves in their immediate vicinity before causing symptoms of intracranial pressure, except in high spinal cord tumors which enter the skull through the foramen magnum. These may result in early obstruction of the outflow of cerebrospinal fluid, causing headache, choked disk, and vomiting.

SURGICAL TREATMENT

The anesthetic of choice in the surgical treatment of brain tumors has been given much consideration. In the greater number of traumatic cases local anesthesia is indicated, but in craniotomies for neoplasms it is not so satisfactory. Most decompressions can be performed without very much pain to the patient, but extensive osteoplastic flap operations are best carried out under a general anesthetic, as traction on the dura produces considerable pain. Some patients co-operate with the surgeon sufficiently to permit a local anesthetic, but in the majority of cases ether is advisable unless there are definite contraindications. Ether administered by the drop method can be employed in practically all craniotomies. It was believed at one time that in all cases of cerebellar tumors the anesthetic should be administered by the intratracheal or intrapharyngeal method, but since it has been possible to insure sufficient air with the ether, and freedom of the mandible, tongue, and neck by supporting the head in a special frame, neither intratracheal nor intrapharyngeal anesthesia is necessary.

Decompression.—In all patients suffering from choked disks of more than 2 diopters decompression is indicated, except when the disks are choked, due to known inflammatory processes under control. I doubt its value in patients suffering from choked disks in conjunction with atrophy which has progressed to a state of blindness in the absence of definite localizing signs, and I do not consider it advisable in patients suffering from headache alone or from headache and vomiting without choked disks. Neither do I consider decompression advisable in patients suffering from grand mal, migraine, or cerebral diplegias without evidence of intracranial pressure, and I believe that in all patients presenting symptoms of localization, even though the suggestive symptoms are slight, exploratory craniotomy is indicated in conjunction with subtemporal decompression at the base of the osteoplastic flap. A surgeon should never be satisfied with performing a decompression only when there is marked evidence of localization, since a patient should by all means be given the benefit of an exploration with possible removal of the neoplasm.

Decompression is of value in cases of slowly progressing choked disks, but is of little value in cases of rapidly developing choked disks of short duration.

Technic of Operation.—A simple decompression should be performed under the temporal muscle, and the skin incision should be made obliquely upward and backward from the zygoma corresponding to the line of radiation of the temporal muscle. After incising the skin, galea, temporal fascia, and muscle the muscle should be carefully elevated with a retractor without being torn loose from its distal attachment. The skull should be trephined, and an area of from 4 to 6 cm. in diameter rongeured away underneath the temporal muscle. After the bleeding is controlled the dura should be opened by a crucial incision and the ventricle tapped, if possible, by a trocar and cannula. Careful exploration of the brain in the immediate vicinity is advisable, since occasionally evidence may be obtained with regard to the position of an unlocalized tumor. The surgeon should be very careful in his palpation and manipulation of brain tissue, and avoid unnecessary trauma to the blood-vessels. The cortex around the tumor should be covered with moist cotton during the operation and the cortex and cotton kept warm with normal saline solution. In closing the wound good coaptation of the muscles, fascia, galea, and skin margin is important; it is best obtained by suturing the different planes of tissue by interrupted sutures of No. 1 silk. The temporal fascia should be closed very accurately so as to insure against disfiguring cerebral hernia. Owing to the danger of infection and the leakage of cerebrospinal fluid the use of drains should be avoided. The patient should always be informed of the defect in the skull following such a procedure, and of the moderate bulging and pulsation that will develop.

Osteoplastic Flap.—Usually exploration of the cerebrum is through an osteoplastic flap with its base in the temporal region. Care must be taken not to disturb the temporal artery if the flap is pedunculated. The location of the base of the flap is optional, but the base must be as broad, if not broader, than the free margin if it does not contain the temporal artery.

Bleeding from the scalp on the flap side is controlled by a pedicle clamp at the base of the flap, compressing the temporal muscle and all the vessels and skin. The bleeding in the scalp around the margins of the incision is controlled by forceps to the galea which are turned out over the skin margin. The forceps are held in place during the operation. Four trephine openings are made with a Hudson drill or by the use of an electric burr. The dura is separated from the skull at various openings, after which the DeVilbiss or the Frazier osteotome attachment to the DeMartell engine is used to narrow in the bony margin from the two lower trephine openings. The Gigli saw is then used between the openings to finish freeing the flap. In using the saw it is well to draw it a little diagonally in order to give the beveled effect in the bone-flap. The bone-flap is elevated and broken at its base in the temporal region. The edges of the wound are carefully covered by towels and soft moist sponges. Careful palpation is made over the cortex for any difference in resistance, for fluctuation, or for the detection of solid masses. If the tumor is situated in the cortex or on the cortex, the dura, skull, and scalp are usually found to be very vascular. Before the dura is opened it is well to drain the lateral ventricle by a brain trocar and cannula. If a tumor is found and cerebrospinal fluid not obtained the dura might be opened over the tumor as well as over the temporal region; but if no tumor is found and no fluid obtained on puncture the dura should be opened with care, except in the subtemporal region immediately under the temporal muscle in the decompressed area produced at the base of the flap. If a glioma is found the advisability of attempting its removal is questionable. It is practically impossible completely to remove a soft mass; if the mass is necrotic or degenerated evacuation of the contents is advisable. Occasionally a glioma degenerates and forms a large cyst, which can be drained, and the remaining nodule or glioma in the cyst wall can be removed.

Removal of Endotheliomas.—If an endothelioma is exposed, it is well to excise the attached dura and carefully dissect away the brain tissue, ligating the communicating vessels or controlling the bleeding with Cushing clips and gently elevating the tumor by traction on the dura. If the endothelioma arises from the falx cerebri or from the meninges under the cerebrum, it may be necessary to incise the cortex in order to expose the tumor and permit elevation. This can be safely done in the temporal, frontal, and occipital lobes. After the tumor has been removed the dura is closed with interrupted silk sutures and the defect covered with animal membrane (prepared peritoneum of the ox). If the endothelioma arises from the longitudinal sinus, particularly from the anterior portion or from the lateral sinus, it is necessary to rongeur away bone or turn a flap to give additional exposure to permit ample room for removal of the tumor. The sinus is very liable to be partially or completely obliterated by endothelial buds of tumor-cells, and resection of the involved sinus in addition to the dura is frequently necessary.

Operations for Cerebellar and Brain Stem Lesions.—In cerebellar and brain stem lesions bilateral cerebellar decompression through a cross-bone incision is advisable, after which the dura over each cerebellar lobe is incised and the occipital sinus doubly ligated and divided. If much pressure is present the lateral ventricle above the lateral sinus should be tapped, through a separate trephine opening, and the lateral ventricle drained through the posterior horn. Cerebellar tumors are approached and removed in the same manner that cerebral tumors are removed. Acousticus tumors and tumors in the cerebellopontine angle are exposed after the bilateral cerebellar decompression and the incision of the dura and occipital sinus. The cerebellar lobe is covered with strips of moist cotton and gently elevated and displaced in order to give ample exposure of the tumor in the angle. It is well to use an illuminating retractor in order to obtain sufficient light, and cotton should be packed around the tumor to prevent the flow of blood underneath the base of the brain. If the lesion is a simple acousticus tumor the capsule is split and the tumor enucleated piecemeal. If the lesion is malignant or has invaded the brain stem, it is questionable whether an attempt at removal should be made. The surgeon may be tempted to enucleate the mass intact, but such manipulation is liable to be attended with severe complications in the form of paralysis of other cranial nerves. Since tuberculomas are masses within the brain substance, if removal is attempted, it is necessary to resect the brain substance around the nodule.

Operations for Suprachiasmal Tumors.—Suprachiasmal tumors on account of their position and the associated bleeding are difficult to remove, and it is questionable whether radical measures should be employed in their treatment. Tumors of the ganglion are approached through the middle fossa much the same as in the division of the posterior root for trifacial neuralgia. Brain abscesses, if exposed through an osteoplastic flap craniotomy, should be carefully drained with as little trauma and soiling as possible, and the cavity washed with normal saline solution and aspirated; small rubber tubes should be brought through a puncture incision or at the edge of the flap to provide for drainage.

Value of Radium.—The exact effect of radium on brain tumors has not yet been determined. It seems probable that it will be a valuable adjunct in the treatment of inoperable tumors, in the prevention of recurrence of tumors when intracapsular removal has been performed, and in the retardation of the growth of partially removed tumors. Apparently better results are obtained by the use of radium in the destruction of endothelial growths than of gliomatous growths. A definite statement with regard to the dosage of radium cannot be made at present, but I believe large doses, more than 1000 mg. hours at a time, are indicated, and the implantation of radium is more effective than external application. Repeated external applications of radium, however, at intervals of from two to three months are beneficial in some cases. When complete removal of a brain tumor is impossible the administration of radium should be considered.

Postoperative care of patients with brain tumors is very similar to the treatment of patients with general surgical conditions. Morphin should be used sparingly, ice-bags should be applied to the head, and the patient should be kept in bed until usually about the fifth day, when he feels strong enough to sit up. The superficial stitches should be removed at the end of seventy-two hours and the dressing changed about every third day until the end of ten days, when it can be removed and the head covered with a comfortable head-dress. Repeated ophthalmologic and neurologic examinations are advisable during convalescence.

END-RESULTS OF OPERATION

Decompressions in mild cases of intracranial pressure from tumor give relief from the headache within a few days after operation, but in severe cases the relief is slower and less complete. The average patient will be free from intracranial symptoms for from six to eighteen months.

Following the successful removal of a brain tumor relief from headache, choked disk, and vomiting is experienced soon after operation, and usually the patient is very comfortable after two or three weeks. Improvement in motor paralysis is early and continues for from six to ten months, when recovery will be either complete or remain stationary. During the convalescence massage and passive motion should always be employed. If there had been symptoms of grand mal an amelioration of the severity of the attacks with a decrease in frequency may be expected for the first two years; if by that time there is no relief, hope for complete freedom from the convulsive attacks should not be entertained. In cases of this type it is advisable to prescribe bromids postoperatively, the dosage varying according to the case, but ranging from 30 to 60 gr. a day for adults.

SUMMARY

1. Decompressions are indicated for patients suffering from intracranial pressure, but they are of no value for patients suffering from migraine, cerebral diplegia, idiopathic grand mal, or for patients who have developed complete optic atrophy without localizing signs.

2. Exploration of the brain with an attempt at radical removal of the lesion is indicated for all patients suffering from localized brain tumors, and should be performed in preference to simple decompression.

3. Doubtless radium will be a valuable adjunct in the treatment of inoperable and partially removed brain tumors.

OCULAR PHENOMENA IN CASES OF CHIASMAL LESIONS NOT OF PITUITARY ORIGIN: REPORT OF 6 CASES

WALTER I. LILLIE

THE early ocular changes produced by lesions of pituitary origin may be summarized as follows: (1) Lowered visual acuity in one or both eyes, (2) characteristic changes in the visual fields, and (3) waxy pallor of the nerve heads without loss of substance.

The progressive field changes due to chiasmal lesions of pituitary origin have been adequately described by Cushing and Walker, who have classified them in four main groups: (1) bitemporal, (2) homonymous, (3) amaurotic, and (4) unclassified. The field changes are also classified according to the progression and type of change: (1) changes in the color fields, (2) changes in the form fields, and (3) bizarre fields, such as scotomatous fields.

The ophthalmoscopic appearance of the nerve heads and the relationship between this appearance and the loss of vision has been described in detail by Benedict: "A peculiar waxy pallor of the nerve without shrinkage is seen so often that it has become practically a diagnositc feature. The pallor is not due to atrophy of the optic nerve, unless vision has been destroyed almost entirely for a considerable length of time and it is accompanied by an atrophic excavation of the disk, such as is seen in atrophy of tabes and toxic neuritis. In the atrophy of tabes the pallor of the disk, the loss of vision, and the shrinkage of the nerve itself progress together; if any difference is found, the vision often seems too good for the extent of pallor and excavation of the disk seen with the ophthalmoscope. In toxic neuritis the vision fails first; the shrinkage of the nerve and the pallor of the disks follow together. In the case of pressure at the chiasm from pituitary or other tumor the appearance of the pallor of the disk may not be noticeable for years after the onset of the loss of vision. The pallor is not accompanied by shrinkage of the nerve substance or atrophic excavation." Benedict's description is in agreement with that of Cushing and Walker, who state, "Despite the so-called atrophic pallor of the disk in patients having visual field defects resulting from lesions in the chiasmal regions, the histologic examination of the nerve fails to show the expected degree of fiber degeneration unless the progress has been of long duration."

From a group of 30 cases of chiasmal lesions for which operation was performed in the Clinic in the past twenty months the 6 cases (20 per cent.) here reported were selected. The remaining 24 cases of this group were of pituitary tumor. These 6 cases are reported in order to show the striking similarity in the ocular phenomena of chiasmal lesions not of pituitary origin to those of chiasmal lesions of pituitary origin (Table 1).

REPORT OF CASES

Case I (A152,904).—Mr. M. R., aged twenty years, was first examined February 24, 1916 because of blindness in the left eye. He had complained of poor vision for two years with diplopia and frequent headaches. Glasses improved the condition for nine months, when he had a very high fever with vomiting and headache, and within three or four hours total blindness in the left eye. The right eye had been normal until two months before examination, when vision had become "smoky" and he could not see to read or write. The headaches persisted over the eyebrows, but they were not so frequent. He had vomited only once or twice during the last three months. He had lost slightly in weight.

The general examination was negative. The roentgenogram of the sella turcica was negative, and the Wassermann reaction on the blood was negative. Vision in the right eye was 20/70, in the left eye nil. The right fundus was negative, but the left fundus showed a complete simple optic atrophy. Perimetric fields showed a temporal hemianopsia in the right eye. The neurologic examination was negative except for the ophthalmic findings. A diagnosis of questionable pituitary tumor was made.

TABLE 1

OCULAR PHENOMENA IN 6 CASES OF CHIASMAL LESIONS NOT OF PITUITARY ORIGIN

Case.	Sex. Age.	Condition of the sella in the roentgenogram.	Visual fields.	Condition of the disks.	Vision.	General condition.
152,904	M. 20	1916 normal. 1920 enlarged, Grade 2, with thinning of the posterior clinoids.	Right temporal hemianopsia. Left eye blind.	Right greenish-white pallor without loss of substance. Left marked pallor without loss of substance.	Right 6/20. Left nil.	Negative. Basal metabolic rate—7 per cent.
298,594	F. 33	Normal.	Reported bitemporal hemianopsia.	Right normal. Left normal.	Right nil. Left nil.	Uterine fibroids. Static tremor of the tongue, hands, arms, and legs. Deep reflexes increased. Babinski on the right. Oppenheim, Rossolino, and Gordon reflexes on the left. Gustatory aura with loss of consciousness. Bárány test: Subcortical tumor above the stem.
342,936	F. 40	Normal.	Right temporal hemianopsia with preservation of the upper outer quadrant. Left temporal hemianopsia.	Right normal. Left temporal pallor with loss of substance.	Right c. f.[1] Left 6/20.	Weakness of the right seventh and left fifth nerves. Basal metabolic rate—3 per cent.
346,907	M. 37	Enlarged Grade 4, with destruction of the posterior clinoids.	Left homonymous hemianopsia.	Right pallor without loss of substance. Left pallor without loss of substance.	Right 6/30. Left 6/15+.	Essential hypertension; distribution of hair feminine in type, muscle strength grade —1. Basal metabolic rate —17 per cent.
358,995	F. 45	Normal.	Bitemporal hemianopsia.	Right slight pallor without loss of substance. Left marked pallor without loss of substance.	Right 6/6. Left 6/30.	Negative.
362,271	M. 29	Enlarged, Grade 3.	Right homonymous hemianopsia.	Right simple optic atrophy. Left simple optic atrophy.	Right 6/30. Left c. f.[1]	6/24/21 basal metabolic rate —27 per cent. 7/14/21 basal metabolic rate —15 per cent.

[1] Counts fingers.

TABLE 2

RELATION OF OPHTHALMOSCOPIC APPEARANCE OF THE NERVE HEADS AND THE DURATION OF THE VISUAL SYMPTOMS

Case.	Condition of the disks.	Duration of the visual symptoms.	Condition of the sella in the roentgenogram.	Pathologist's diagnosis.
152,904	Right greenish-white pallor without loss of substance. Left marked pallor without loss of substance.	Right four years. Left six years.	1916 normal. 1920 enlarged Grade 2 with thinning of the posterior clinoids.	Supratentorial basal tumor, malignant.
298,594	Right normal. Left normal.	Two years in both eyes, worse in the left.	Normal.	Glioma of the middle brain.
342,936	Right normal. Left pallor with loss of substance.	Eighteen months in both eyes.	Normal.	Basal-cell endothelioma.
346,907	Pallor of both disks without loss of substance.	Four years in both eyes.	Enlarged Grade 4 with destruction of the posterior clinoids.	Unable to remove specimen for an examination.
358,995	Right slight pallor without loss of substance. Left marked pallor without loss of substance.	Six months in both eyes, worse in the left.	Normal.	Psammoma of the meninges.
362,271	Right simple optic atrophy. Left simple optic atrophy.	Four years in both eyes, worse in the left.	Enlarged Grade 3.	Basal cellular glioma.

March 23, 1916 a right subtemporal decompression was performed (Dr. Beckman). Considerable cerebrospinal fluid escaped, but it was not under much pressure. The patient was dismissed after an uneventful convalescence.

January 21, 1920 the patient returned to the Clinic because vision in the right eye had failed since his previous visit to the Clinic. He had had periods in which the vision was poor, but generally the vision had remained good until the last few months, when it had failed steadily. Examination revealed the vision in the right eye to be 3/60, in the left eye nil. The pupils were equal; the right pupil reacted promptly to direct light and in accommodation; the left pupil did not react to light, but reacted in accommodation. The right nerve head was greenish white throughout without loss of substance; the arteries and veins were normal. In the left eye the media were clear; the nerve head showed a marked pallor without loss of substance (Fig. 577). The patient developed a mild attack of influenza and was in bed one week. A slight cough persisted, and he felt weak, although his appetite improved steadily. The general examination after influenza was negative except for a mild bronchitis. The roentgenogram of the head showed the sella turcica slightly

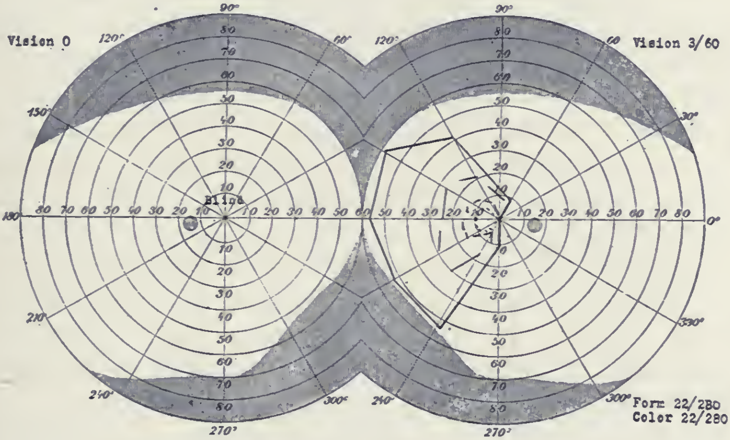

Fig. 577.—(Case A152,904.) Right eye, temporal hemianopsia. Left eye blind.

enlarged, with thinning of the posterior clinoids, trephine in the right temporal region. The neurologic examination was objectively negative except for eye findings. The metabolic rate was −7 per cent. A diagnosis of pituitary tumor was made. The patient returned home to recuperate from the influenza before operation.

The second operation was performed May 11, 1920. At this time the vision in the right eye was 1/60, in the left eye nil. The fundi were the same as previously reported. Dr. Adson operated, and reported findings as follows: "A mass was found situated between the optic peduncles and extending underneath the brain. This mass was dark red without definite capsule, and did not come down into the sella, but up between the peduncles, spreading them for a distance of 3 cm. Some tissue was removed for diagnosis, but the tumor could not be removed." A diagnosis was made of supratentorial basal tumor. The pathologist reported malignancy. The patient died May 13, 1920; necropsy was refused.

Ophthalmologically this case could not be differentiated from that of pituitary tumor. It is interesting to note that the sella showed no change so far as could be determined by the roentgenogram until nearly five years after the onset of the visual symptoms.

Case II (A298,594).—Miss B. L., aged thirty-three years, was examined December 2, 1919 because of loss of vision in both eyes. Radium treatment in April and in June for fibroid tumor of the uterus had controlled the hemorrhages she had had every month. July 1st she awakened with blurred vision in both eyes; this gradually grew worse until she was only able to read the headlines in the paper. She was able to continue her work, checking large figures, until October 18th. In walking on the street she often bumped into persons coming upon her left side, but she was able to see them in front of her or on her right side. The left eye became worse more suddenly than the right. For the last five weeks she had been unable to detect light. During the last two weeks she had had three attacks of loss of consciousness. She knew of one attack, and this caused her more anxiety than the blindness; she was not told of the other attacks. The attacks came on in the night, with deep breathing and frothing at the mouth. She was not rigid, but she could not be aroused for one-half hour; the next day she was very tired. For the last five weeks she had been conscious of a peculiar odor, as of coal-gas, for half a second or so, with a peculiar sensation in her nose and on the right side of her throat.

General examination revealed uterine fibroids. A roentgenogram of the sella turcica showed it to be normal. The roentgenogram of the chest revealed slight bronchial thickening. The Wassermann test on the blood was negative; the nasal pharynx was negative. The eyes were normal in size, shape, and position. The pupils were dilated equally and reacted sluggishly to light and in accommodation. Vision in both eyes was nil. Examination of the fundus in the right eye revealed a pink nerve head, the margins of which were slightly blurred at the outer and lower border, but no swelling; in the left eye the nerve head was pink and oblong in shape; otherwise the fundi were negative. A letter from Dr. Litchfield, of Minneapolis, stated that September 23d the patient had had a temporal hemianopsia in the left eye and temporal hemianopsia in the right eye, with contraction of the nasal field. The neurologic examination revealed a static tremor of the tongue, hands, arms, and legs. Deep reflexes were increased. The Babinsky reflex was positive on the right side; the Oppenheim, Rossolimo, and Gordon reflexes were positive on the left side. The Bárány test suggested pressure above the stem and beneath the cortex (subcortical). The diagnosis was tumor in the region of the pituitary, probably partially above the chiasm.

December 12, 1919 the patient was operated on by Dr. Adson. The notes dictated at the time of the operation are: "A tumor was found between the optic peduncles; the line of cleavage between the brain and tumor could not be dissected. The left peduncle could not be seen. The right peduncle was about four times normal size; its outer surface was purplish and looked as if it might cover a tumor or hematoma. In the attempt to enucleate the tumor by first opening the capsule severe arterial hemorrhage developed which was difficult to control. Only a portion of the tumor was removed." The pathologist's report was glioma.

The patient died the evening of the operation. On necropsy a glioma of the middle brain was found infiltrating the optic tract, with marked increased intracranial pressure and herniation of the right temporoparietal lobe. The sella turcica was unusually deep.

The ophthalmologic examination in this case gave no suggestion as to the location of the tumor. At the time of our examination the patient's vision was nil and no visual fields could be obtained. The bitemporal hemianopsia reported to us and the normal nerve heads found at our examination led us to believe that the patient had a chiasmal lesion. The neurologic examination revealed a definite localization of the tumor.

Case III (A342,936).—Mrs. O. D. T., aged forty years, was examined December 6, 1920 because of poor vision in both eyes. She had first noticed loss of vision in January, 1920, when in reading she could see the last half of the word before she saw the first half. Vision gradually diminished until she was unable to read. About four months ago she had noticed that she could see better out of the inner corners than out of the outer corners of the eyes; this was more noticeable in the right eye. For about fifteen or twenty years she had had infrequent headaches which had incapacitated her for a day or two, but she had had none recently. Her general health had been good and she had had numerous general examinations without finding a definite cause for her trouble. All her teeth had been removed. The physician who referred her to the Clinic reported "bitemporal hemianopsia; vision in the right eye, ability to count fingers at 10 inches in the nasal field, vision in the left eye 20/100; fundus negative. The patient has mild glycosuria."

The general examination revealed blood-sugar 0.136 per cent. and no diabetes. The Wassermann tests on the blood and the spinal fluid were negative; there were 9 lymphocytes to the field. Roentgenograms of the skull were negative. The metabolic rate was −3 per cent. Vision in the right eye was recorded, ability to count fingers 2 feet in the nasal field; vision in the left eye 6/20. The pupils were equal and reacted somewhat sluggishly. On the examination of the media in the right eye a few floating vitreous opacities were noted; the nerve head was round, of good color, perhaps slightly pale in the temporal half; in the left eye the media were clear, the nerve head round, rather pale in the temporal half, with perhaps a slight loss of substance. The pallor of the disks was not sufficient to be typical of pituitary tumor. The visual fields showed bitemporal hemianopsia with preservation of the upper outer quadrant in the right eye, loss of vision for all color in the right eye, and loss of vision for green in the left eye (Fig. 578). The neurologic examination revealed slight weakness of the left fifth nerve, and apparently slight weakness of the left seventh nerve around the mouth; the deep reflexes were slightly increased. A diagnosis of brain tumor near the chiasm was made, not typical of pituitary tumor. The patient was dismissed December 18th without operation.

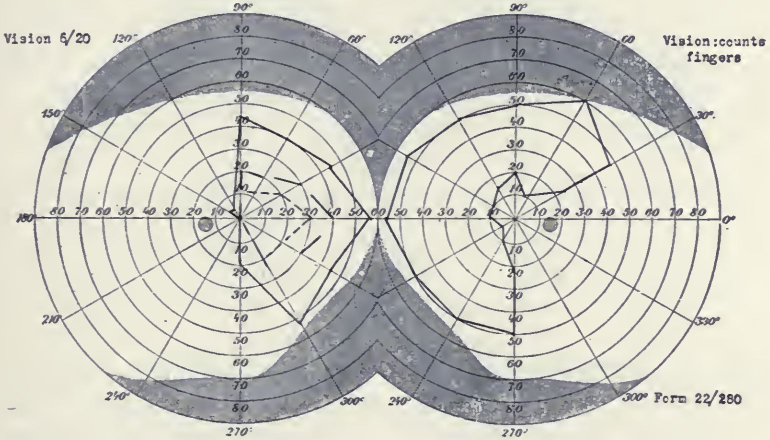

Fig. 578.—(Case A342,936.) December 6, 1920. Right eye: loss of part of the superior temporal quadrant and all of the inferior temporal quadrant, including the macular region; no recognition of colors. Left eye: temporal hemianopsia; no recognition of green.

April 5, 1921 the patient returned to the Clinic. Examination of the eyes showed vision of the right eye 1/30 nasally, vision of the left eye 6/60. The fields showed a bitemporal hemianopsia with loss of vision for green color in both eyes. The fundi were not changed (Fig. 579). Neurologic examination at this time did not show any material change in the findings. The spinal fluid was negative. The Nonne test was positive; there were two small lymphocytes to the field. The Wassermann reaction on the blood of the husband was negative. Exploration of the chiasmal region seemed to be indicated.

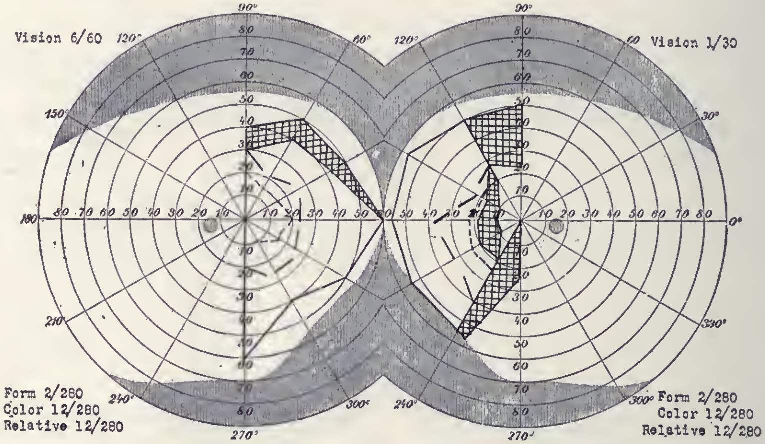

Fig. 579.—(Case A342,936.) April 5, 1921. Right eye: temporal hemianopsia, including the macular region; the relative field does not extend into the temporal half. Left eye: complete temporal hemianopsia with division of the macular region and slight relative field in the superior nasal quadrant. No recognition of green in either eye.

April 12th the chiasmal region was explored (Dr. Adson). A tumor was exposed, granular in appearance, situated between the optic peduncles. Apparently it had broken through its capsule and extended in the sella from behind and underneath the base of the brain; it was purplish red and extremely fibrous.

Fifty milligrams of radium was buried in the growth for twenty-four hours. The patient's convalescence was uncomplicated except for restlesssness. The pathologists reported endothelioma.

May 5th the eyes were examined. Vision in the right eye was 6/60, in the left eye 5/60. The pupils were equal, the reflexes normal. The fundus of the right eye was normal; in the left eye the nerve head was pale without loss of substance; otherwise it was negative. The fields showed improvement with return of vision for all colors, but a persisting bitemporal hemianopsia (Fig. 580). The neurologic examination at this time did not reveal changes.

The marked pallor of the left nerve head with the slight loss of substance and the first field, which shows the loss of the lower temporal quadrant with preservation of a sector of the upper temporal quadrant, led us to believe that the tumor in this case was not of pituitary origin.

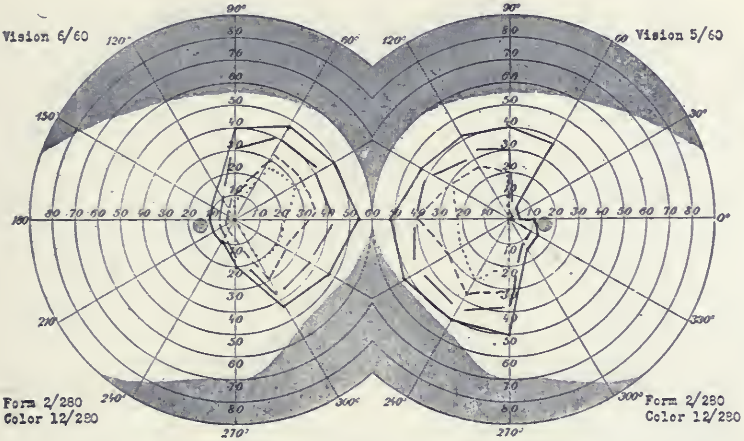

Fig. 580.—(Case A342,936.) May 4, 1921. After exploration of endothelioma of the chiasmal region. Bitemporal hemianopsia, not including the macular regions.

Case IV (A346,907).—Mr. S. W., aged thirty-seven years, was examined January 20, 1921 chiefly because of severe headaches in the left frontal region which had persisted for fifteen years; each attack had lasted for from one to two hours; the pain had varied from a dull to a very sharp pressing type; it had been worse in the daytime. For the past six years he had vomited once or twice during a month without nausea. Five years before examination he had had to give up tailoring because of trouble with his vision. He had used glasses for twelve years with success until the last five, since when his vision had failed gradually; glasses had not improved it. In 1918 the eyes had revealed a left homonymous hemianopsia; since then the eyes had gradually failed, with a persistence of headaches with nausea.

The general examination revealed an essential hypertension; the systolic blood-pressure was 220, the diastolic 138. The ear, nose, throat, and nasopharynx were negative; the Wassermann reaction on the blood was negative. Roentgenograms of the head showed the sella turcica to be greatly enlarged, with destruction of the posterior clinoid processes. The metabolic rate was —17 per cent. Vision in the right eye was 6/30 with correction, in the left eye 6/15 with correction. The pupils were equal and reacted normally. The cornea and media were clear. The fundi showed pallor of both disks without excavation; there was no loss of substance, and no evidence of previous swelling of the disk. The macular regions were negative. The perimetric fields showed a left homonymous hemianopsia (Fig. 581). Neurologic examination was practically negative except for a pubic distribution of hair, feminine in type, and slight loss

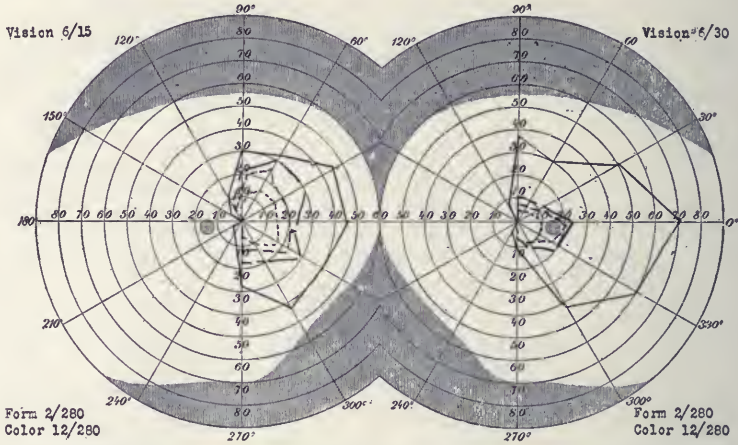

Fig. 581.—(Case A346,907.) January 21, 1921. Left homonymous hemianopsia with contraction of the fields for form and color of both eyes.

of strength. Intelligence and co-operation were slightly below normal. A diagnosis of questionable pituitary tumor was made.

A right subtemporal decompression was performed for exploration of the tumor (Dr. Adson). "A purplish gray tumor was found situated underneath the brain stem posterior to the optic commissure, involving the brain posterior to the commissure, but the optical peduncle and commissure in front were perfectly free and not stretched. On account of the extent and position of the tumor further surgery was not advisable."

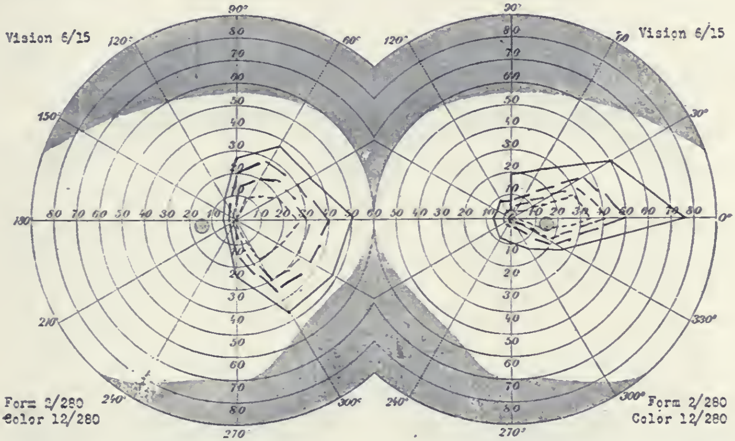

Fig. 582.—(Case A346,907.) February 5, 1921. Condition after right subtemporal decompression. Left homonymous hemianopsia with contraction of the fields for form and color of both eyes.

The patient convalesced uneventfully and the wound healed by primary intention. Postoperative neurologic and eye findings were the same as before operation, except that the fields were slightly more contracted (Fig. 582).

Case V (A358,995).—Mrs. W. V. D., aged forty-five years, was examined May 23, 1921 because of poor vision. About six months before she had begun to notice that her eyesight was poor; she had been unable to see objects until they were almost in front of her, especially on the left side. She had had slight dizziness for the last two weeks, without headaches, but with a slight tendency to nausea. She had felt well generally, and had not lost weight. Two weeks before she had had a spinal puncture with resulting pain across the hips and back. The roentgenographic report sent with the patient was "erosion of the sella."

A general examination of the patient was negative. The Wassermann reaction on the blood was negative. A roentgenogram revealed the sella to be normal in size and contour. The blood and urine were negative. Vision in the right eye was 6/6, in the left, 6/30; the pupils and reflexes were normal. The fundi showed slight pallor of the nerve head without loss of substance in the right eye, and marked pallor of the nerve head without loss of substance in the left eye. The fields showed bitemporal hemianopsia with loss of vision for green (Figs. 583, 584). The neurologic examination was negative except for a slight diminution of the abdominal reflexes. A probable pituitary tumor was diagnosed.

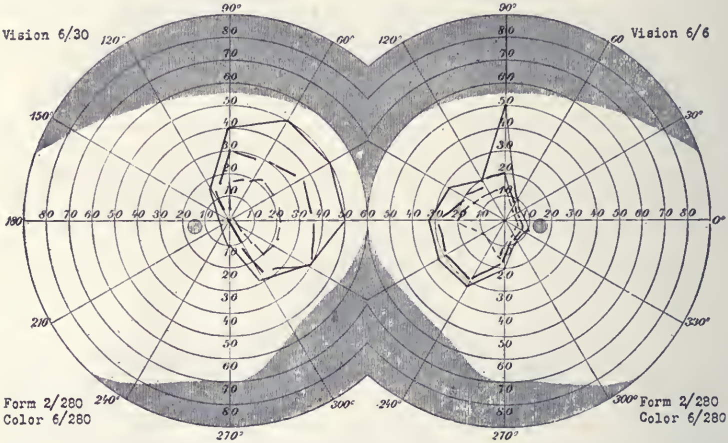

Fig. 583.—(Case A358,995.) May 19, 1921. Bitemporal hemianopsia with contraction of the nasal fields for form and color of both eyes.

May 31st, an operation was performed (Dr. Adson). "A granular encapsulated tumor was found resting on the optic commissure, pushing out the right optic peduncle and concealing the left optic peduncle. The capsule was opened, but the tumor could not be enucleated as is usually possible in cases of ordinary pituitary tumor. Tissue was removed which proved to be extremely fibrous. The tumor, which was about 5 cm. in diameter, was coming from the arachnoid and pressing the left optic peduncle down and outward and the right optic peduncle outward. By careful dissection the entire tumor was removed and the sella was left undisturbed." The pathologist's diagnosis was psammona, meningeal tumor.

The patient reacted normally and was conscious and cheerful the night after the operation. At 2 A. M. she became unconscious, the pulse became irregular, and she threw her hands around wildly. She died suddenly the afternoon of the second day. Necropsy was refused.

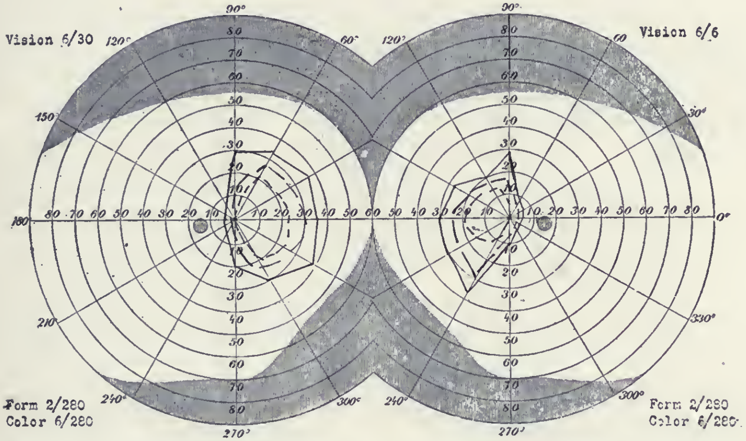

Fig. 584.—(Case A358,995.) May 24, 1921. Condition practically the same as that in Fig. 583.

CASE VI (A362,271).—Mr. H. C., a farmer aged twenty-nine years, came to the Clinic June 21, 1921 complaining of loss of vision in the left eye and failing vision in the right eye. The past history was negative except for an attack of influenza in 1918 followed by a good recovery. In 1917 the patient had noticed that his vision was poor in the left eye and had consulted an oculist, who gave him glasses without any improvement in the vision. This examination had revealed lost vision in the left eye and poor vision in the right.

The general examination showed periapical infection of seven teeth. June 30th the basal metabolic rate was —27 per cent. and July 14th —15 per cent. The blood-sugar was 0.11 per cent. The roentgenogram of the sella turcica showed a moderate enlargement, but it was otherwise negative. The vision of the right eye was 6/30; fingers could be counted with the left eye. There was marked blepharospasm, with photophobia and slight drooping of the lids. The pupils were equal and reacted normally. The media were clear. The fundi showed marked simple atrophy of both nerve heads with loss of nerve substance; the margins were distinct and the lamina cribrosa were plainly seen. The macular regions were slightly granular. The perimetric fields revealed a right homonymous hemianopsia (Fig. 585). We believed that this was a suprasellar growth, as the fundi were not typical of pituitary growths. The neurologic examination was negative except for the eye findings, and a diagnosis of probable pituitary tumor was made.

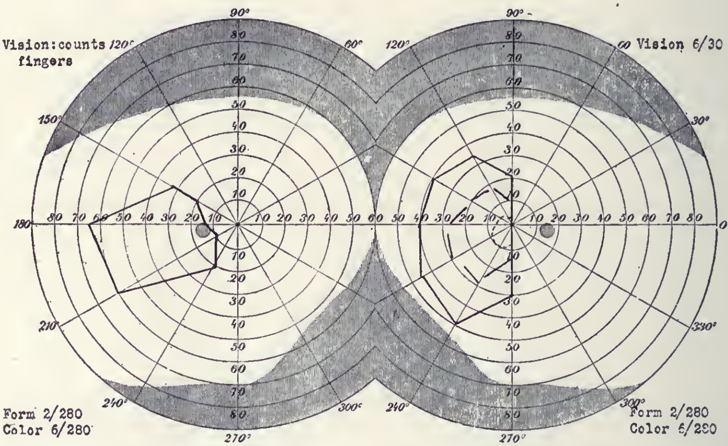

Fig. 585.—(Case A362,271.) Right homonymous hemianopsia with contraction of the form fields. No recognition of green in the right eye. No recognition of colors in the left eye. No relative fields with any size test object.

August 2, 1921 operation was performed (Dr. Adson). "The right lateral ventricle was drained and about 45 c.c. of cerebrospinal fluid escaped. The right frontal lobe was elevated and the sella exposed. The optic chiasm was found to be pushed backward and upward by a tumor which arose from the base and involved the sella. It was definitely encapsulated, 4 by 3 cm. in diameter, and bluish gray. On splitting the capsule between the optic peduncles a very pulpy cellular content and some blood escaped." Fifty milligrams of radium in a rubber tube was inserted for twenty-four hours. The pathologist's report was cellular glioma.

The patient died August 3d, and necropsy revealed a glioma of the left temporosphenoidal lobe, coming forward and involving the sella, and hyperplasia of the thymus and lymphoid tissues.

The marked simple optic atrophy in this case, although the other ophthalmologic findings could have been of pituitary origin, led us to believe this to be an extrasellar growth.

SUMMARY

1. Primarily all of the patients in the series came to the Clinic because of failing vision or complete loss of vision in one or both eyes.

2. Definite ophthalmic lesions were found in all the patients at the time of examination in the Clinic, while only 2 showed definite neurologic changes.

3. In 4 of the patients the ocular changes could not be distinguished from those characteristic of a pituitary syndrome, which shows the necessity of careful examination of the fields and fundus early in the course of the disease in order to detect the progressive changes. This would have been of great advantage in the preoperative diagnosis in the 4 cases which were not distinguished from pituitary tumor.

4. Only one of the patients (Case A298,594) gave a history of changes in menses; she had uterine fibroids which had been treated by radium.

5. None of the 6 patients had any evidence of acromegaly, and in 4 of the cases in which the metabolic rate was estimated it varied from —3 to —27 per cent.

6. Four patients died and 2 necropsies were obtained. Nothing has been heard from the remaining 2 with regard to changes in vision and fields.

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OBSERVATIONS IN THE MANAGEMENT OF CHRONIC FRONTAL SINUSITIS WITH EXTERNAL MANIFESTATIONS: REPORT OF 22 CASES

Harold I. Lillie

Recent medical literature dealing with chronic suppurative frontal sinus disease manifests an ultraconservative tendency. My position with regard to the treatment of this condition is in accord with the opinions of Eagleton[1] and Coakley,[2] namely, that certain cases require drainage and others require operation.

In advising an external operation the physician has in mind the eradication of the disease process for the relief of symptoms. In accepting the advice the patient has in mind the possibility of facial asymmetry, or perhaps deformity, and the fact that previous conservative measures have not sufficed to relieve the symptoms. That there is some danger is apparent, but the danger is no greater than that which any major operation entails.

A cure, *restitutio ad integram*, cannot be said to have been accomplished because of the necessity of interfering with the physiologic function and the anatomic relations. However, relief of symptoms from the patient's standpoint is accomplished.

MATERIAL STUDIED

The material for this study consists of 22 cases observed in the Mayo Clinic, 2 in 1917, 3 in 1918, 6 in 1919, and 11 in 1920. All the patients presented themselves at the Clinic with external manifestations of diseased frontal sinuses. Sixteen had discharging fistulas, 5 had subperiosteal abscesses, and 1 had evidence of a mucocele. All but 4 patients had had some extranasal operation performed. In several the frontal sinus could be entered readily through the nose. In no instance, however, had a really so-called radical operation been performed. The operations had been about equally performed by general surgeons and by specialists in diseases of the nose and throat. This fact is significant.

CLINICAL OBSERVATIONS PREVIOUS TO SURGICAL INTERVENTION

Before deciding to perform the external operation it has been customary carefully to observe patients and to make use of all available intranasal and therapeutic diagnostic measures. Roentgenograms were taken particularly to show the conformity and size of the sinuses. In 3 instances the pathologic condition was definitely shown; in 1 the frontal sinus was filled with bismuth paste (Figs. 586, 587), and in 2 sequestra were shown. A lateral view will reveal the depth of a sinus, and the patient should be frankly told that there is more danger of deformity in the deep type. This did not, however, deter our patients from accepting the advice of a radical operation; they were apparently thoroughly discouraged with the results of conservative measures.

OPERATIVE INTERFERENCE

Our early experience has shown that the most formidable part of an external operation is the intranasal, because of the bleeding and the inversion of the anatomic relations to what one is more accustomed. Late in 1919 a two-stage operation was decided on in such cases. Under local anesthesia the nasofrontal duct was enlarged, and the nasofrontal ethmoids and anterior ethmoids were carefully exenterated; in fact, if multiple sinusitis were present, an effort was made to perform as much as possible of the operation intranasally (Fig. 588). Important details were found to be the flattening of the lateral wall anterior to the anterior end of the middle turbinate in the agger nasi, care in smoothing off the rough edges (this is best accomplished by a hand burr), and the careful removal of all shreds of membrane. The latter procedure has tended to lessen the formation of the granulation tissue that ordinarily fills the nasofrontal region in these cases.

In 3 cases the intranasal operation proved to be sufficient to effect relief of all symptoms. In 1 of the 3 it was necessary to

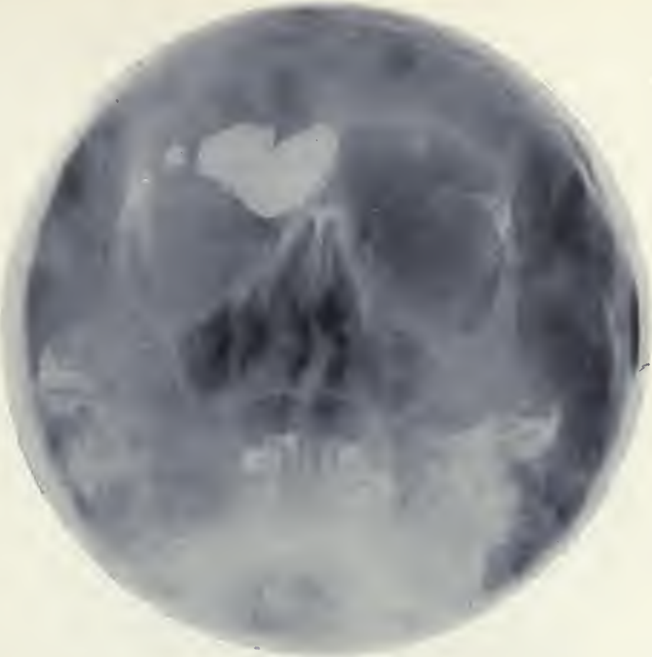

Fig. 586.

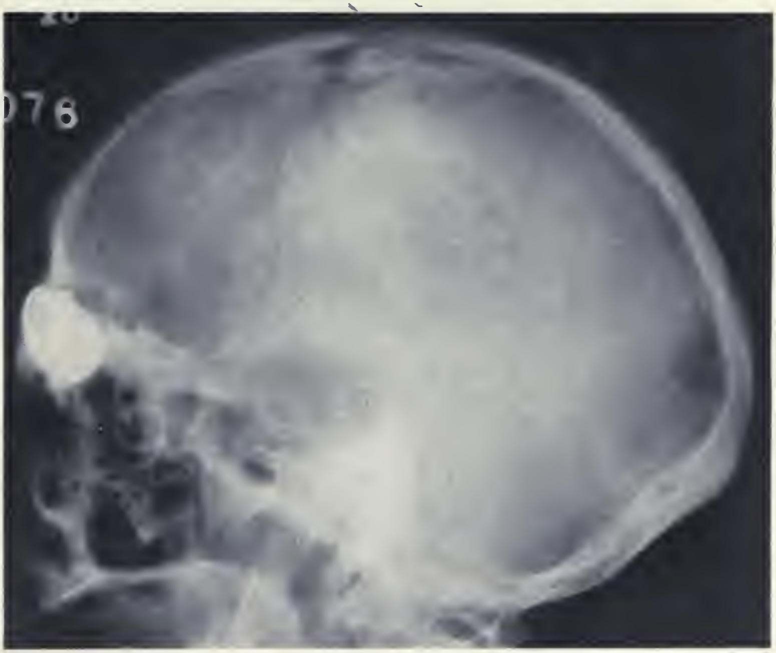

Fig. 587.

Figs. 586, 587.—(Case A337,076.) Bismuth paste in frontal sinus with definite pockets above and to the side.

make an artificial nasofrontal duct (Fig. 589). Occasionally it was necessary to correct a widely deflected septum before the first stage of the operation could be accomplished.

As a general rule the external operation was instituted within a week or ten days after the intranasal operation. Modifications of the Killian operation, to suit the case in hand, were used. General anesthesia was used in most instances, but good nerve-blocking anesthesias are preferable in selected cases.

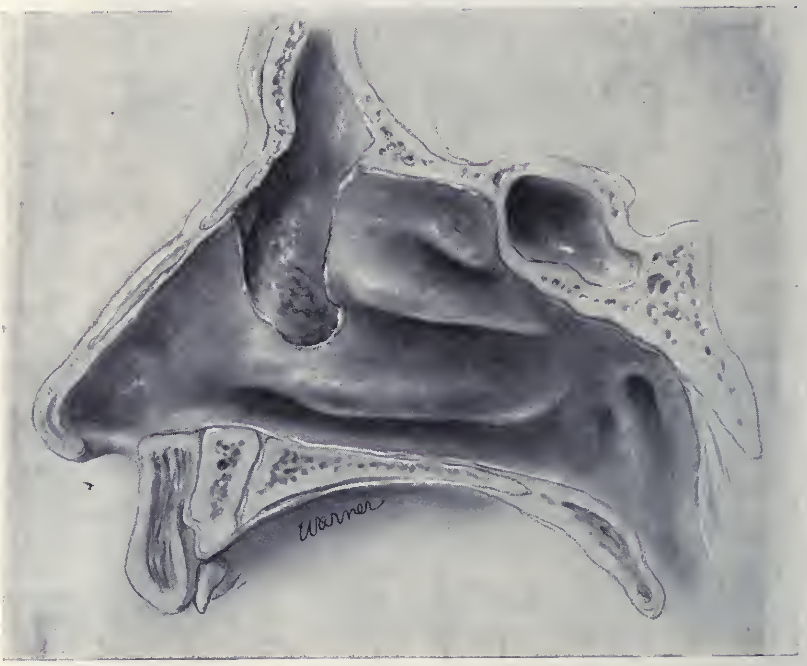

Fig. 588.—Intranasal procedure in frontal sinus operation.

The choice of the incision depends on the size and conformity of the frontal sinus. If the intranasal stage of the operation has been accomplished satisfactorily the incision should be carried just above the eyebrow or just below it, since this causes much less scarring, that is, there will be no scar to separate or divide the eyebrow. In closing the wound nicks may be made in the skin to aid in the proper approximation. The incision may be

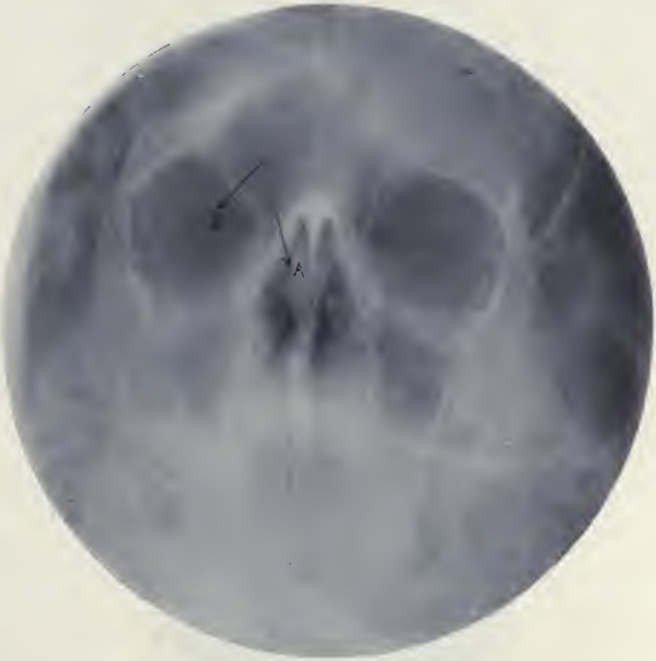

Fig. 589.—(Case A347,731.) *A*, Artificial nasofrontal duct; *B*, break in supra-orbital wall by pyocele.

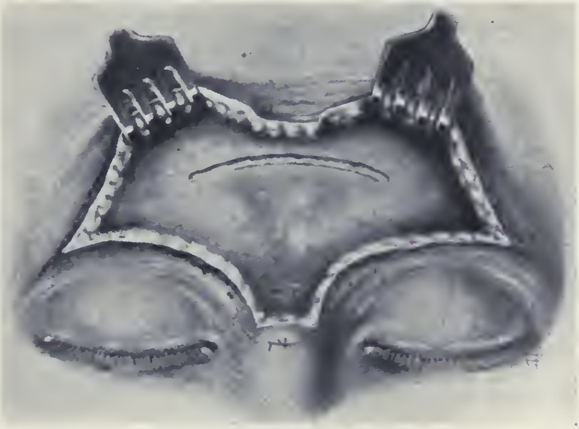

Fig. 590.—Beck's incision.

carried laterally as far as is indicated. If it is found that the sinus extends well up toward the hair line, or is larger than its fellow, spreading past the midline, or, if it is necessary to perform a double operation, I prefer to use the incision suggested by Beck (Fig. 590). Vertical incisions in unilateral cases always leave scars (Fig. 591).

To be sure of eradicating any disease presupposes sufficient exposure. The initial removal of the outer table of the frontal sinus is accomplished by the use of a gouge. Rongeurs are then employed to remove the outer table and to bevel the upper and lateral extremities. This latter procedure is important in avoiding the obviousness of postoperative deformity by not allowing abrupt angles for the soft parts to fall over. It also avoids infected pockets (Fig. 592). Constant use of the probe for finding pockets is advantageous. Pocketing and overhang defeat the purpose of well-intended surgical procedures dealing with disease processes involving bone. Careful smoothing of the inner table with removal of mucous membrane is important. Avoidance of the use of the gouge on the inner table, to lessen the danger of fracture, is important. Scarification of the under surface of the periosteum insures better coaptation.

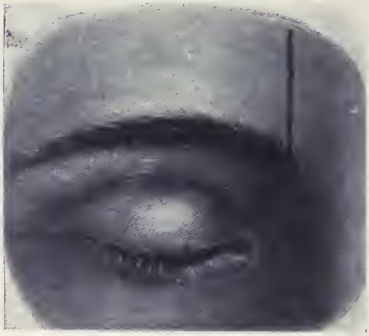

Fig. 591.—Hajek's incision.

The superior wall of the orbit is removed as far as is necessary in order to uncover any lateral ethmoid cells which are frequently found, if looked for. The nasofrontal duct region is left for the final part of the operation, which is readily accomplished because of the previous intranasal operation. A lateral frontal ethmoid cell just below the dense bone of the nasoseptal side is looked for and frequently encountered. This has been brought out also by Coakley. In case a double frontal has been performed, the nasofrontal duct regions are joined somewhat after the method suggested by Lathrop. This procedure has been used in 3 cases with good results. There is less tendency for the formation of granulation tissue. The orbital ridge is taken down rather more than would seem indicated, particularly in the larger deep sinuses, to allow less apparent depression. I am not ready to accept the suggestion that any external operation should include both sinuses, whether or not the other is diseased, even though the deformity will be less apparent.

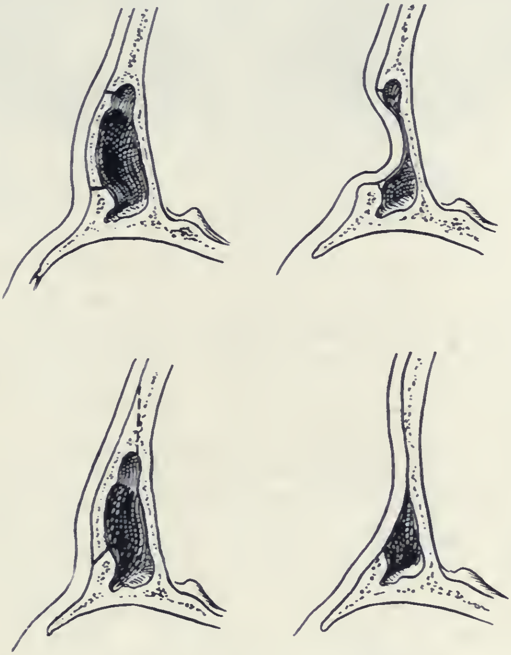

Fig. 592.—Diagrams showing beveling of bone edge to avoid pocketing.

Vaselin gauze strips protruding from the nose are used for packing. Cigarette drains have been discarded because one was torn by a bone spicule, necessitating opening the outer wound for its removal. The wound is closed with interrupted silkworm-gut sutures to insure strength and eversion of the lips of the wound (Fig. 593). Continuous dermal sutures close the skin.

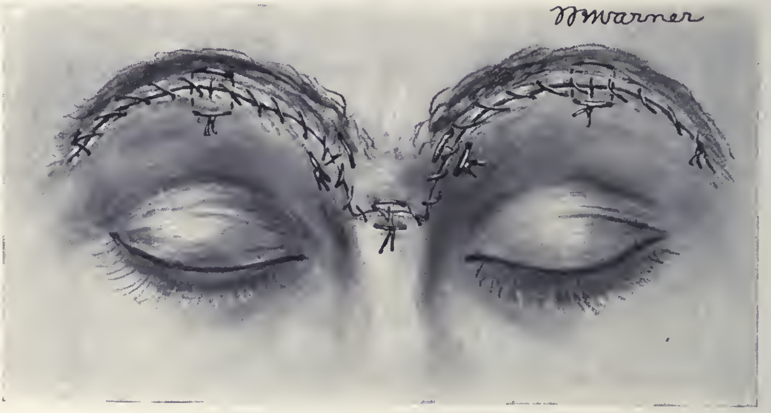

Fig. 593.—Closure of wound without external drainage.

PATHOLOGIC CONDITIONS

In all the cases in which operation had been performed elsewhere, bony overhang producing pockets filled with infected granulations was encountered. In no instance had the disease process been sufficiently exposed. It was probably hoped that drainage would clear up the condition, as extranasal packs had been used in all cases of fistula. In 5 cases in which operation had been performed pressure necrosis had caused a break through the outer table, in 3 into the orbit, and in 2 over the forehead. All the orbital cases without fistulas responded to the intranasal stage of the operation. In 3 instances a definite hypertrophic osteitis was encountered, probably the same type of process that occurs in chronic mastoiditis.

Necrosis with softening of the bone as the result of the disease process was frequently encountered. All apparent diseased bone was radically removed. In one case a general surgeon had performed the operation for specific osteitis of the frontal bone which was found to extend into the frontal sinus. Because a probe could be passed through the nasofrontal duct from above downward he believed that drainage was sufficient. As the process did not respond well, even under intensive antispecific treatment, the external frontal sinus operation was performed. This revealed a sclerosing reparative process including several lateral actively infected pockets. Following the external operation the healing was rapid and complete.

One frontal sinus was filled with bismuth paste. The intranasal operation permitted the removal of a portion of the paste, but as the roentgenogram showed that all had not been removed, the external operation was performed (Figs. 586, 587). An infected pocket, lateral to the bismuth paste, was found; it accounted for the persistent trouble of which the patient complained. Two cases showed sequestration; in both of these there had been severe injury followed by infection. To leave the periosteum over the strip of bone for support of the soft parts has not seemed important.

In one case the disease process had uncovered the dura. The bone was removed until the healthy dura was exposed, with satisfactory results. One patient with an external fistula through the left side, who had had two external operations, was found to have a pansinusitis on both sides. The right side cleared up with the intranasal portion of the operation; the left side required the external operation.

POSTOPERATIVE COURSE

After the patient has recovered from the anesthetic the sitting posture is preferred because the patient is more comfortable. We have found that removal of the external dressing after the second or third day lessens swelling and hastens healing. The intranasal packing can be removed on the third or fourth day. In none of our cases was it necessary to repack. Patients should not be allowed to clear the nares by blowing the nose.

The sutures may be removed the day following the removal of the packs. As a matter of fact, little after-care is indicated other than the mechanical cleansing of the nares, preferably with an antrum cannula attached to a suction apparatus (Fig. 594). This avoids trauma of the membrane. Lavage is used only occasionally because of the tendency to "water-log" the membranes. Ventilation by air is helpful. In the final stage of resolution, when crusting takes place, the patient's use of liquid vaselin is helpful in the mechanical removal of the crusts.

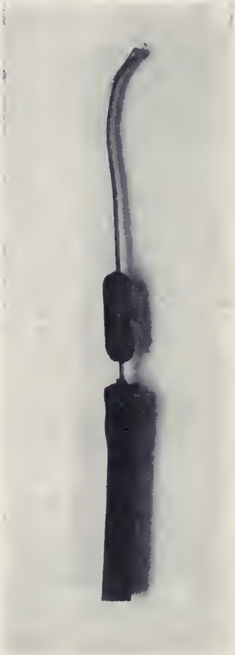

Fig. 594.—Antrum cannula.

COMPLICATIONS

Nearly all the patients had a slight rise in temperature for a few days, particularly until the intranasal packing was removed. One patient had a chill and a rise of temperature to 104° F., but after the removal of the pack no further incident occurred. Three patients developed tonsillitis. With the occurrence of a febrile postoperative course other causes should be ruled out before the operative field is considered to be the cause.

There were 4 cases of diplopia. Three (Fig. 589) were postoperative and cleared up in one week; these were earlier cases in which the one-stage operation was performed. The fourth case was an orbital pyocele which produced proptosis; the disease cleared up, but the diplopia persisted. The patient stated that this did not trouble him.

Three patients had well-marked chemosis. The one-stage operation had been performed for all; the patient in whom the chemosis was most marked had had the peri-orbita injured at operation. Care in handling the orbital contents is very essential, and subsequent to this case has seemed to be the means of avoiding the chemosis.

Meningitis occurred in a patient in whom both sides were involved and in whom a hypertrophic osteitis of the inner table was encountered. Necropsy showed that the inner table had been fractured and the dura injured. There was no external evidence, of course, since in such a case the inner table would appear negative, whereas the inner surface would gape. Had this been recognized, I believe that uncovering the dura might possibly have prevented the death of the patient. One patient, several weeks after healing had occurred, developed a lung abscess, but this cleared up finally under general care. The cause of this complication cannot be definitely determined, but probably it was due to metastasis.

APPARENT REASONS FOR THE DEFEAT OF PREVIOUS OPERATIONS

It seems apparent that insufficient exposure, failure to obliterate the diseased pockets, and leaving a bony overhang were important factors in the failures. Non-removal of the supra-orbital wall has a tendency to cause granulation in the nasofrontal duct region which the smooth surface of the periorbita seems to avoid. Exposition and exenteration of the lateral ethmoid cells are very important points; this was demonstrated in 2 of our earlier cases in which the second operation revealed this to be the cause of our failure. The use of external drainage is not necessary and is too liable to cause more scar and, what is worse, fistulas. There is no one operation that is suitable for all cases.

I am of the opinion that more careful obliteration of the disease process, and beveling the bone angles so that the soft parts will not form patent pockets, are important factors in the success of the operation from the curative and cosmetic standpoints. I feel sure that meddlesome postoperative attention often defeats well-directed surgical procedure.

CONCLUSIONS

1. A two-stage operation has many advantages in the management of frontal sinusitis with external manifestations.
2. The external operation requires good exposure, careful elimination of pockets, and the leveling of bone edges.
3. Vertical incisions for exposure should be avoided.
4. The incision suggested by Beck is preferable for exposure of a large single sinus or of both sinuses.
5. External drainage is not necessary.
6. Early removal of the external dressing adds to the comfort of the patient and diminishes reaction and swelling.
7. Little after-treatment is necessary.

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CLINIC OF DR. GORDON B. NEW

CASE I. RHINOPHYMA. CASE II. RHINOSCLEROMA

Case I (A342,802).—Mr. W. J. S., a race-track gambler, aged sixty years, came to the Clinic December 4, 1920 on account of a huge growth on the tip of the nose which had started eighteen years before. The patient was a very heavy drinker. He had noticed the enlargement for the first time after being drunk for three weeks. The enlargement had gradually increased. The only treatment had been local application. He had had syphilis thirty-five years before, but had not been treated.

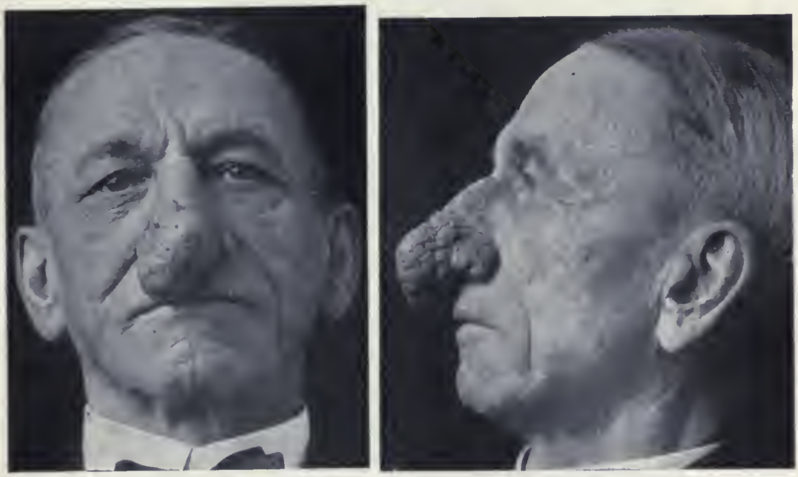

Fig. 595. Fig. 596.

Figs. 595, 596.—(Case A342,802.) Rhinophyma of eighteen years' duration before treatment.

Examination revealed an irregular, soft nodular tumor about 4 cm. in diameter extending from and involving the tip of the nose. Both alæ were thickened and freely movable. The appearance is typical of rhinophyma (Figs. 595–597).

A syphilitic lesion, tertiary stage, on the left hand was treated before the operation, which was performed January 3, 1921 under ether anesthesia. The huge tumor was pared from the nose by means of knife and scissors. There was considerable oozing, which was stopped by hot compresses. A vaselin dressing was applied. A day or two after the operation the wound was exposed to the heat of an electric bulb for the purpose of decreasing the secretion. In two weeks the raw area had almost entirely healed.

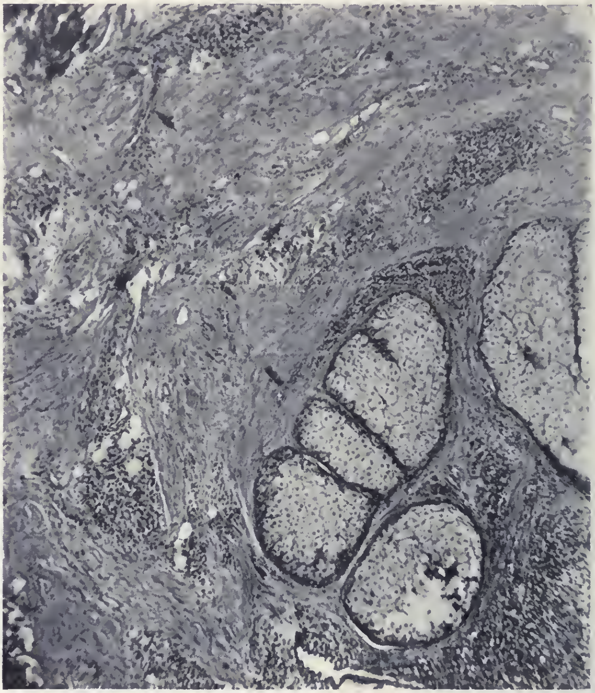

Fig. 597.—(Case A254,933.) Photomicrograph of rhinophyma.

Comment.—In 1919 I published an article drawing attention to the fact that rhinophyma should be treated by decortication. Various other methods of treatment, however, are still in use. Types of flaps and skin incisions have been advocated, and some observers recommend skin-grafting following decortication, but it is only necessary to pare off the tumor by means of a knife or a pair of scissors to the desired size. The index-finger of the left hand should be inserted into each nostril as required to prevent paring through into the nose. Usually there is a great deal of oozing, but this is readily controlled by the application of hot compresses and a vaselin dressing. The following day the dressing is removed, the wound is left open to the air, and heat is applied by means of an electric-light bulb to dry the secretions. In a few days little islands of epithelium will be noticed over the denuded area. These are formed from the cut ends of the hypertrophied ducts, and usually in the course of two weeks the raw surface is fairly well covered with epithelium. The cosmetic result is all that could be desired (Fig. 598).

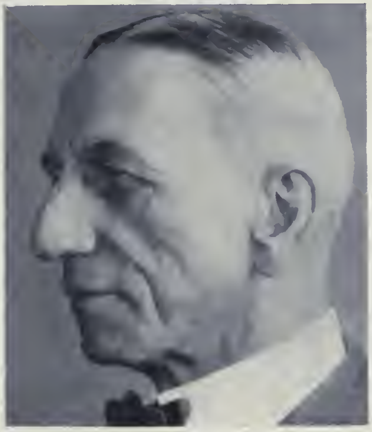

Fig. 598.—(Case 342,802.) Patient shown in Figs. 595, 596 after treatment.

Case II (356,595).—Mr. D. K., aged twenty-seven years, an unmarried farmer, born in Russia, came to the Clinic for examination May 2, 1921 because of enlargement of the nose and nasal obstruction. The condition had been noticed one year before following an injury by a kick from a horse. The injury did not seem severe; there was no external bruising. Soreness, a gradual swelling of the nose, a foul discharge, and gradual obstruction to breathing developed. There was very little enlargement externally until within the last six months.

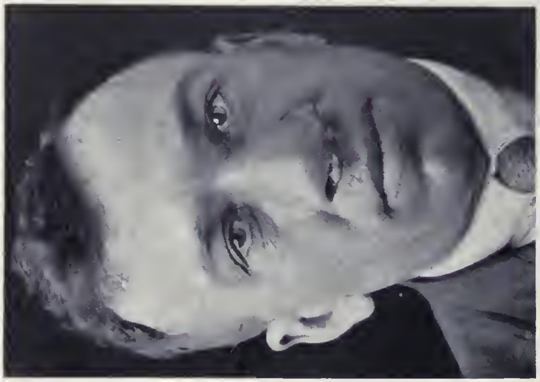

Fig. 599.

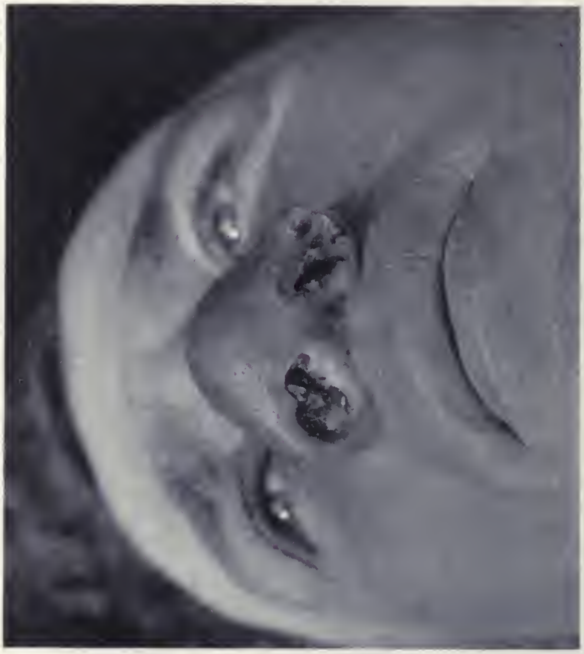

Fig. 600.

Figs. 599, 600.—(Case 356,595.) Rhinoscleroma of one year's duration before treatment.

Examination revealed granulomatous masses, which filled both nostrils. The nose was about three times its normal size, measuring about 6 cm. across. The meati were occluded almost entirely (Figs. 599, 600). The soft palate was pulled up into the nasopharynx, but was not ulcerated. The nasopharynx was concentrically contracted with areas of granulomas, but no ulceration. The condition was diagnosed rhinoscleroma on the clinical, the bacteriologic, and the microscopic examination of tissue (Figs. 601, 602).

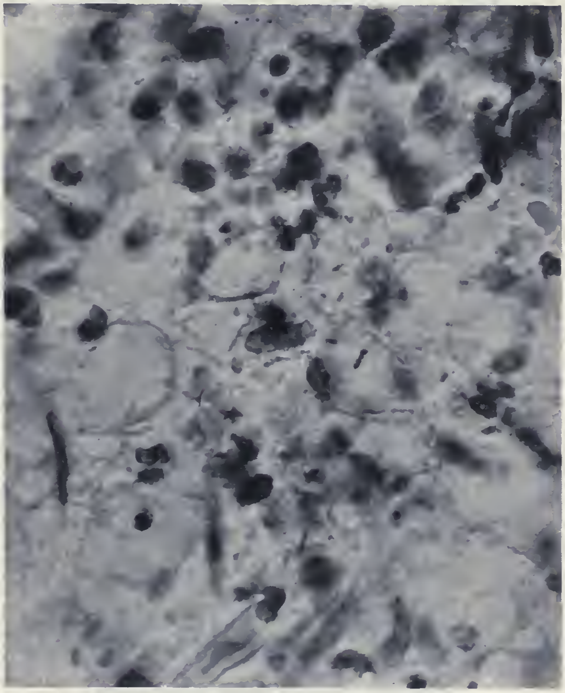

Fig. 601.—(Case A356,595.) Rhinoscleroma; note intracellular micro-organism.

Treatment.—Radium was used. The first series of treatments was given between May 11th and May 13th. A 50 mg. tube of radium, with the container only as screening, was inserted into either nostril for four hours each. On a nasopharyngeal applicator 50 mg. was inserted into the nasopharynx for six hours. In June similar treatment was given in both nostrils, and July

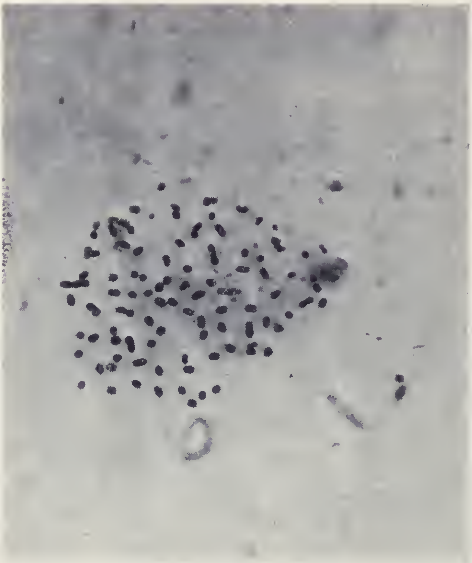

Fig. 602.—(Case A356,595.) Culture of organism from rhinoscleroma.

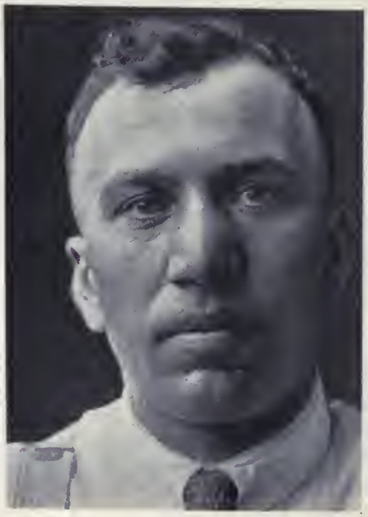

Fig. 603.—(Case A356,595.) Patient shown in Figs. 599, 600 after treatment.

22d the nasopharynx was treated for four hours by a 66 mg. tube of radium. The improvement has been striking. The huge tumor has shrunk, leaving a very good cosmetic result. The condition is clinically cured (Fig. 603).

Comment.—Rhinoscleroma is a granulomatous neoplasm which affects the nose, nasopharynx, larynx, and trachea, and is due to a micro-organism similar to, if not the same as, the bacillus of Friedländer. At one time the condition was limited to the inhabitants of Central Europe; it now seems to be more wide-spread throughout the world. All cases in this country in my investigation of the literature previous to the publication of an article by Watkins in 1921 were of foreign-born persons.

The *x*-ray and radium seem to offer the best chance of cure in these cases, but since the former is not applicable in the treatment of a lesion in the mucous membrane the use of radium is preferred. Vaccine, salvarsan, caustics, and so forth, have been used, but without definite results. This is the third case in which I have used radium; all the results are striking.

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EPITHELIOMA OF THE EAR: A STUDY OF 63 CASES[1]

ALBERT C. BRODERS

No one should attempt a prognosis with regard to a neoplasm without knowing something of its microscopic nature, its size, and its location. In this series of 63 patients three types of epithelioma from the protective epithelium of the ear were encountered, namely, basal-cell epithelioma or rodent ulcer (Figs. 604, 605), squamous-cell epithelioma (Figs. 606–609), and melano-epithelioma (Figs. 610, 611). While all of these epitheliomas are cancers, there is a great difference in the effect they produce on the patient. It is well known that basal-cell epithelioma is the least malignant and melano-epithelioma the

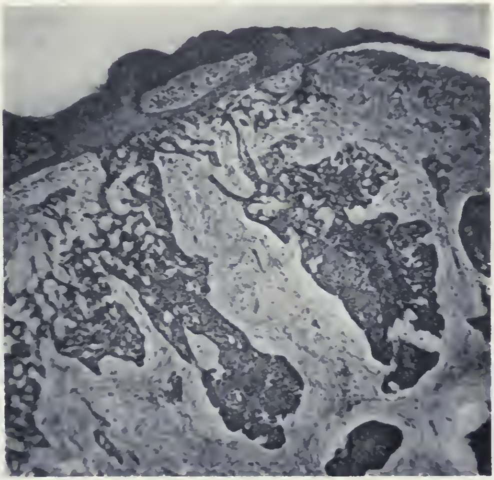

Fig. 604.—(Case A71,769.) Basal-cell epithelioma of the cheek.

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[1] Presented before the American Otological Society, Atlantic City, June 2, 1921.

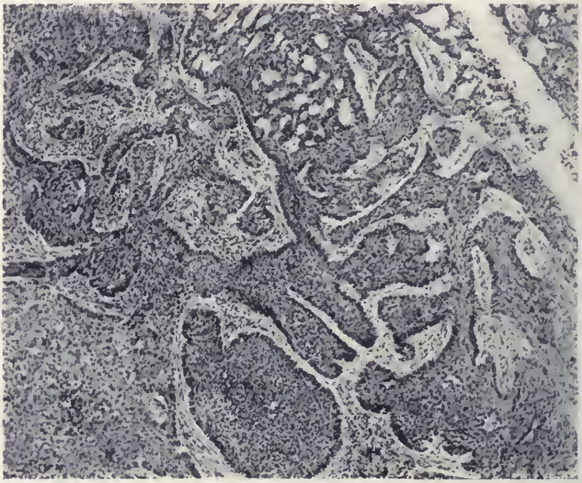

Fig. 605.—(Case A45,739.) Basal-cell epithelioma of the ear.

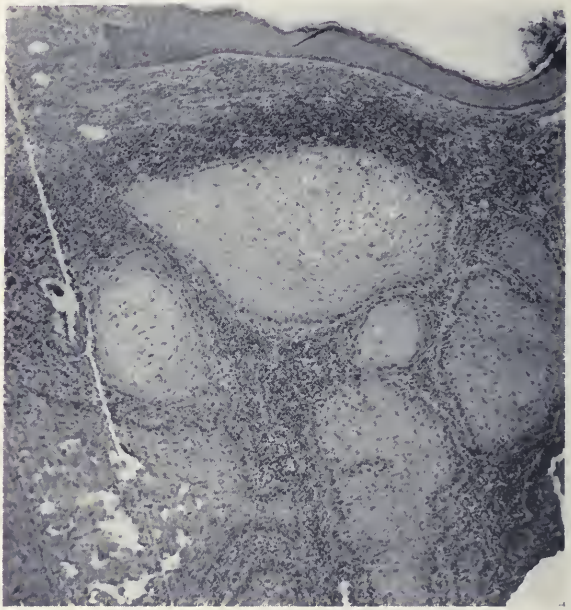

Fig. 606.—(Case A237,504.) Squamous-cell epithelioma of the ear, Grade 1.

most malignant of the three; the squamous-cell epithelioma is graded between the two. In an article on squamous-cell epithelioma of the lip I divided the epitheliomas into four groups, according to degrees of cellular activity, based for the most part on differentiation. Keratinization or pearly body formation was considered complete differentiation. If an epithelioma showed a marked tendency to differentiate, that is, if about three-fourths of its structure was differentiated epithelium and one-fourth undifferentiated epithelium, it was graded 1; if the differentiated and undifferentiated epithelium were about equal, it was graded 2; if the undifferentiated epithelium formed about three-fourths of the growth and the differentiated about one-fourth, it was graded 3; if there was no tendency of the cells to differentiate, it was graded 4. The number of mitotic figures and cells with single large deeply staining nucleoli (undifferentiated cells) plays an important part in the grading. The Grade

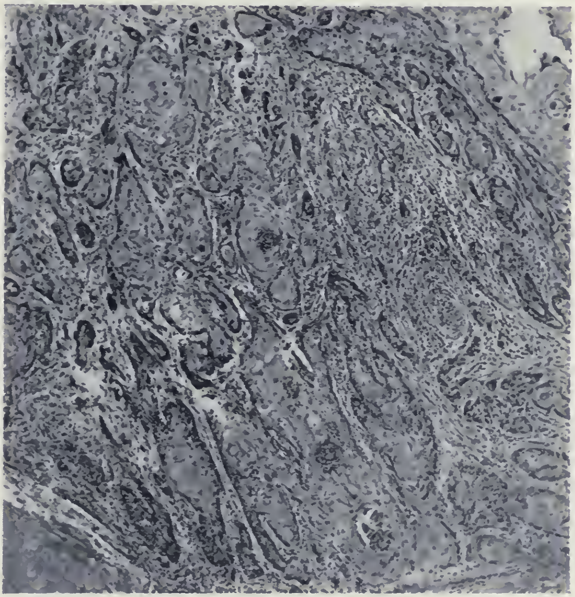

Fig. 607.—(Case G251.) Squamous-cell epithelioma of the ear, Grade 2.

4 squamous-cell epithelioma corresponds in malignancy very closely to the melano-epithelioma, while the basal-cell epithelioma is slightly less malignant than the Grade 2 squamous-cell epithelioma.

Of the 63 patients in the series, 76.19 per cent. were males and 23.80 per cent. were females; the average age was sixty-one and one-fourth years. Sixty-four and forty-four-hundredths per cent. of the males were farmers. Nineteen and four-hundredths per cent. had a family history of malignancy; 63.49 per cent. had a history of a previous wart, mole, scab, keratosis, ulcer, eczema, pimple, or lump at the site of the lesion; 19.04 per cent. had a history of injury or infection. The average duration of the lesion was 4.11 years; the average maximum diameter was 3.22 cm. Eighty-four and twelve-hundredths per cent. of the lesions

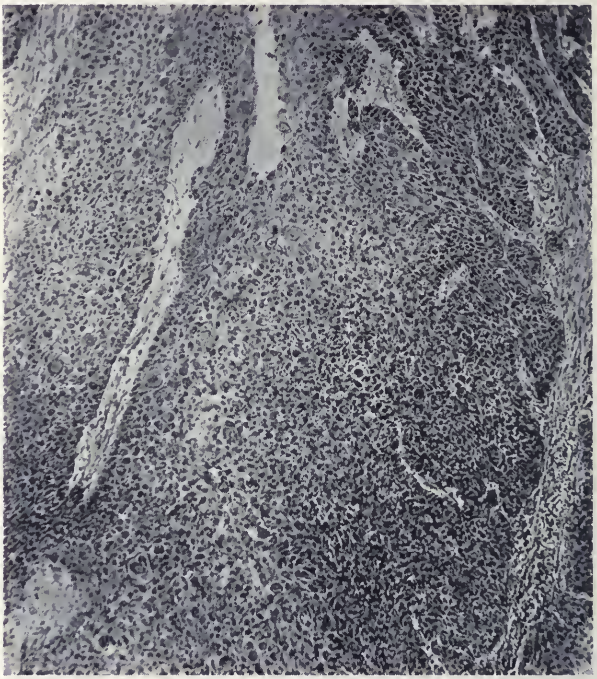

Fig. 608.—(Case A198,659.) Squamous-cell epithelioms of the ear, Grade 3.

were located on the auricle, 14.28 per cent. in the external auditory canal, and 1.58 per cent. in the middle ear (Figs. 612, 613). Forty and eighty-one-hundredths per cent. of the lesions in the auricle were located primarily on the helix, 28.57 per cent. on the concha (anterior and posterior surface), 18.36 per cent. on the lobe, 6.12 per cent. on the scapha, 4.08 per cent. on the triangular fossa, and 2.04 per cent. on the tragus.

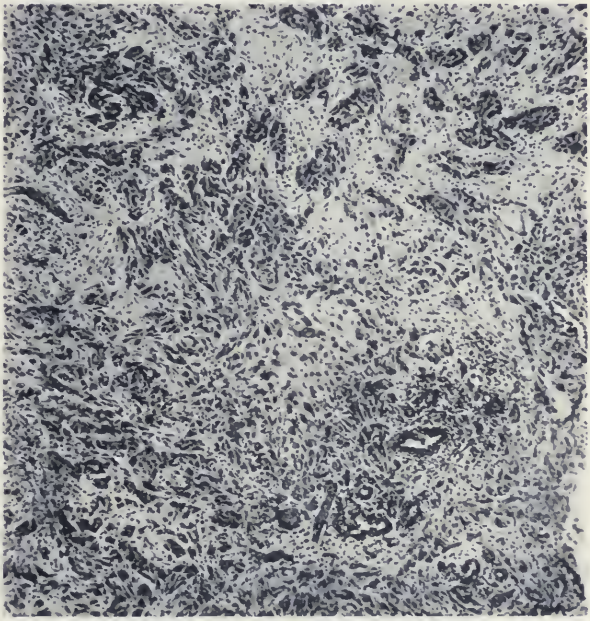

Fig. 609.—(Case A182,497.) Squamous-cell epithelioma of the ear, Grade 4.

Thirty-nine and sixty-eight-hundredths per cent. of the patients had had non-surgical treatment, 28.57 per cent. had had surgical treatment, and 53.68 per cent. had had a combination of treatments before entering the Clinic.

Of the 63 cases, 56 were operable and 7 were inoperable. In 92.85 per cent. of the 56 operable cases treatment was surgical, and in 7.14 per cent. radium alone was used. In 46.15 per cent. of the cases treated surgically radium treatment also was employed, and in 3.84 per cent. *x*-ray treatment also was employed.

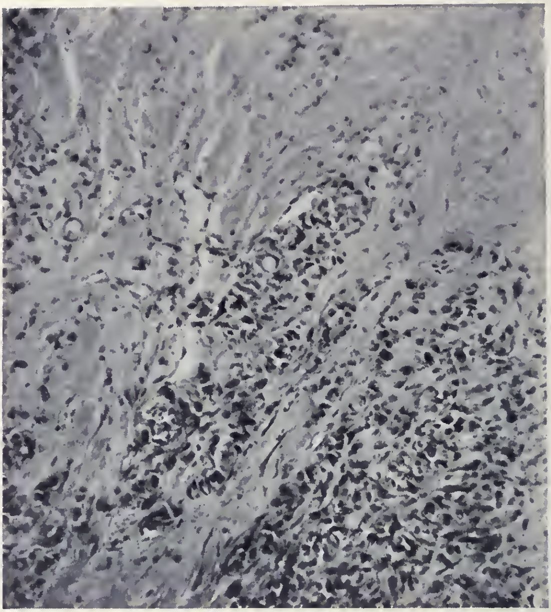

Fig. 610.—(Case A158,771.) Melano-epithelioma of the ear.

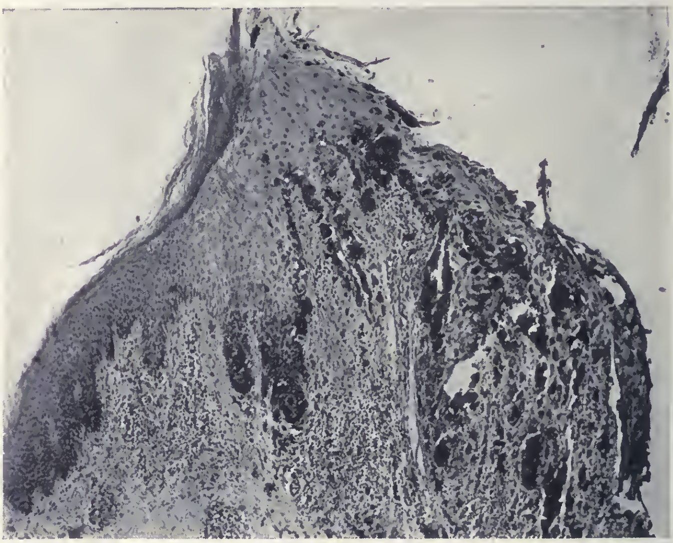

Fig. 611.—(Case A160,912.) Melano-epithelioma of the calf of the leg.

In 42.85 per cent. of the 7 inoperable cases *x*-ray treatment was employed, and in 14.28 per cent. radium treatment.

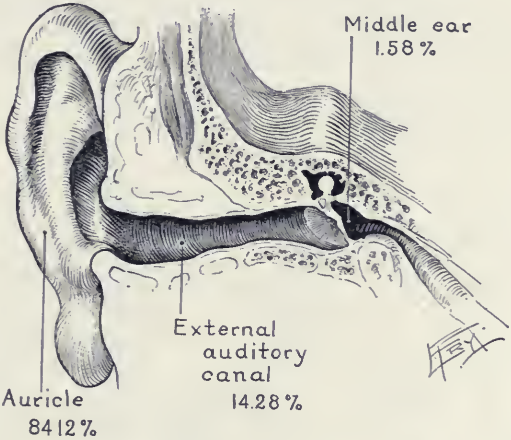

Fig. 612.—Percentage of location of lesions.

Sixty-one and ninety-hundredths per cent. of the epitheliomas in this series are of the squamous-cell type; 33.33 per cent. are of the basal-cell type, and 4.76 per cent. are of the melanotic type. Of the squamous-cell epitheliomas, 5.12 per cent. are of Grade 1, 66.66 per cent. are of Grade 2, 23.07 per cent. are of Grade 3, and 5.12 per cent. are of Grade 4.

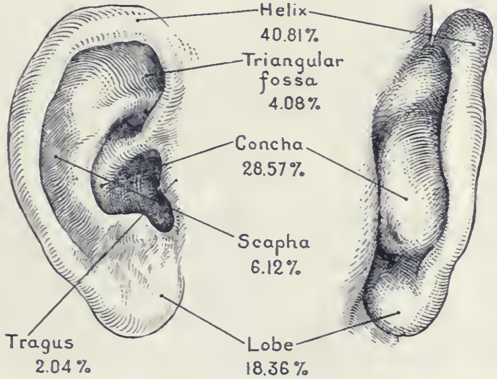

Fig. 613.—Percentage of location of lesions on the auricle.

Of the 7 patients in whom the regional lymph-nodes were removed, 85.71 per cent. had metastasis. The involvement of the regional lymph-nodes and salivary glands found at operation was as follows: Parotid lymph-nodes, 50 per cent.; external jugular nodes, 50 per cent.; parotid salivary gland, 33.33 per cent.; submaxillary lymph-nodes, 16.66 per cent.; superior deep cervical nodes, 16.66 per cent., and inferior deep cervical nodes, 16.66 per cent., most of the patients having involvement in more than one group of glands (Fig. 614).

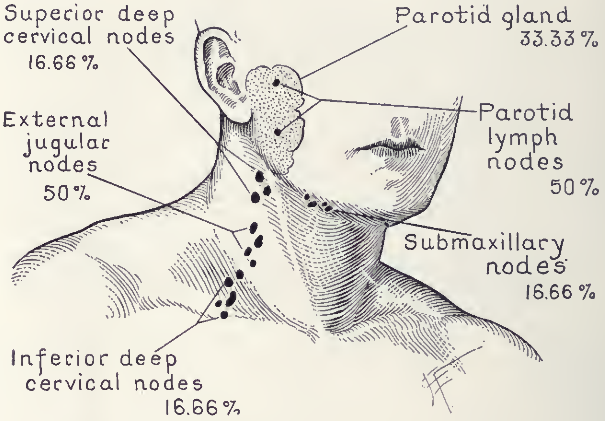
Superior deep cervical nodes 16.66 %
Parotid gland 33.33 %
External jugular nodes 50 %
Parotid lymph nodes 50 %
Submaxillary nodes 16.66 %
Inferior deep cervical nodes 16.66 %

Fig. 614.—Percentage of location of metastasis.

RESULTS

Forty-seven and five-hundredths per cent. of the patients are alive, with good results. The average duration of life since the last or only operation, or non-operative treatment, was 3.53 years; 20.58 per cent. are alive with fair results after an average duration of life of 5.44 years; 32.35 per cent. are dead, with poor results, after an average duration of life since the last or only operation or non-operative treatment of 1.63 years. Four patients are dead whose results were not reported, or who died too soon after the operation to be considered from the standpoint of good, poor, or fair results.

In the cases of melano-epithelioma 100 per cent. poor results followed treatment.

In the cases of basal-cell epithelioma 58.33 per cent. of the patients are alive, with good results, 25 per cent. are alive, with fair results, and 16.66 per cent. are dead, with poor results.

In the cases of squamous-cell epithelioma 45 per cent. of the patients are alive, with good results; 20 per cent. are alive, with fair results, and 35 per cent. are dead, with poor results.

In the cases of squamous-cell epithelioma in Grade 1, one patient (50 per cent.) died, the result of treatment is not known; in Grade 2, 50 per cent. are alive, with good results, 25 per cent. are alive, with fair results, and 25 per cent. are dead, with poor results; in Grade 3, 42.85 per cent. are alive, with good results, 14.28 per cent. are alive, with fair results, and 42.85 per cent. are dead, with poor results; in Grade 4, 100 per cent. are dead, with poor results.

In the cases with metastasis 100 per cent. poor results were obtained; in the cases without metastasis 100 per cent. good results were obtained, and in cases in which no regional lymph-nodes or salivary glands required removal (all squamous-cell epitheliomas) 53.33 per cent. of the patients are alive, with good results, 26.66 per cent. are alive, with fair results, and 20 per cent. are dead, with poor results.

In the cases of lesions in the auricle 51.61 per cent. of the patients are alive, with good results, 16.12 per cent. are alive, with fair results, and 32.25 per cent. are dead, with poor results.

In the cases of lesions in the external auditory canal 66.66 per cent. of the patients are alive, with fair results, and 33.33 per cent. are dead, with poor results.

Results in connection with the size of the epithelioma are as follows: large (4 cm. and over) 50 per cent., with good results, and 50 per cent., with poor results; medium (2 cm. to 4 cm.) 38.46 per cent., with good results, 15.38 per cent., with fair results, and 46.15 per cent., with poor results; small (2 cm. and under) 53.33 per cent., with good results, 33.33 per cent., with fair results, and 13.33 per cent., with poor results.

Of the 7 inoperable cases, death is known to have occurred in 5. The location of the epithelioma in the 7 patients was as follows: in the auricle in 3 cases, in the external auditory canal in 3, and in the middle ear in 1.

PRIMARY TUBERCULOUS PERICARDITIS

CARL A. HEDBLOM

TUBERCULOSIS is probably a much more frequent cause of pericarditis than is generally recognized. Bamberger,[2] in 1872, and later McPhedran state that next to rheumatic fever it is the most frequent cause. Even though a non-tuberculous pericarditis may occur in the presence of a tuberculous lesion elsewhere, it would seem probable that most cases of pericarditis that cannot be proved to be pyogenic are tuberculous. It is generally accepted that most cases of primary idiopathic pleurisy with effusion and of adhesive pleuritis are tuberculous. The analogy of the latent adhesive pericarditis found so often at necropsy and of the pericarditis with effusion in tuberculous persons is striking. Tuberculous pericarditis may become secondarily infected by pyogenic organisms, as in a case reported by Kob.

Tuberculous pericarditis is usually secondary to a tuberculous lesion elsewhere in the body. At necropsy the most commonly found associated focus is of the mediastinal or tracheobronchial lymph-glands. Less often the lungs or pleuræ are involved. In some cases the pericardial process is part of a general polyserositis or of a miliary tuberculosis. Thym, in a study of 94 cases in which detailed findings were given, found that there was pulmonary involvement in 53, miliary tuberculosis in 22, and tuberculosis of other organs without pulmonary involvement in 14. In 5 the condition appeared to be primary in the pericardium.

The relative incidence of pericarditis in tuberculous patients is variously given. Osler found the pericardium involved at necropsy in 7 of 275 cases. Willigk noted 11 cases in 1317 necropsies. Wells, in 1048 necropsies, found pericardial adhesions in 128. The process was acute in 71 and chronic in 57. Of the acute cases, 8 were proved to be tuberculous. Metcalf noted that the pericardium was involved in 5 per cent. of cases of active tuberculosis.

The occurrence of a primary isolated tuberculous pericarditis, apart from glandular or other lesions elsewhere, has been questioned, and by some categorically denied (Bamberger,[1] Schrötter,[38] Strümpell). There are, however, a few reported cases in which the most careful and painstaking search at necropsy has failed to reveal a trace of tuberculosis outside the pericardium. Orth states that such cases are apt to be found in old persons. Whether or not in such cases there may have been a minute lesion that was overlooked becomes a question of academic interest only. McPhedran states that it is becoming more and more generally accepted that the lymph-glands are always the seat of primary infection, and that the various tissues and organs subsequently infected are invaded by way of their lymphatic vessels. On this basis all cases of tuberculous pericarditis associated only with involvement of the mediastinal or tracheobronchial lymph-glands may be considered as primary. If *Bacilli tuberculosis* are present in glands that appear perfectly normal, as reported by Maraglioni, Romberg, Pizzini, and Bartel, it would seem to indicate that a primary tuberculous process may develop in the pericardium through these lymph channels.

Rokitansky is credited with being the first to mention primary tuberculous pericarditis. He says that inflammation of pericardium often occurs in original combination with inflammation of other serous sacs, and that it is usually associated with and dependent on an earlier tuberculous condition. Thaon in 1872, however, states that it may be primary.

The first reported case of primary tuberculous pericarditis, according to Noscov, was by Quinquand and Lejard in 1872. Thym in 1897 cites 5 cases from the literature, but 1 of these, judging from the details given, was probably secondary. I have observed one case at the Mayo Clinic of proved tuberculous nature, and clinically primary, and have been able to collect from the literature 7 cases in which at necropsy a tuberculous pericarditis was found, but in which no trace of tuberculosis could be made out either in lymph-glands or in organs. This makes a total of 13 cases.

HISTORY OF PATIENT OBSERVED AT THE MAYO CLINIC

Case 358,127.—Mr. H. A., aged thirty-six years, presented himself at the Mayo Clinic May 14, 1921, complaining of dyspnea, an uncomfortable sensation in the precordium, and slight edema of the legs. His wife had died of pulmonary tuberculosis one year before. In June, 1920 the patent had had an attack of sore throat with fever, and felt weak and listless afterward. In July a roentgenogram showed a large cardiac shadow characteristic of pericarditis with effusion. He was in bed two months following this, during which time phlebitis developed in both legs. There was no appreciable change in the pericardial condition. In August his afternoon temperature had been 100° to 101° F., his pulse 120. He had noticed a slight loss in weight and strength, cold night-sweats, pain at the costal margins, and cough without sputum. Repeated physical examinations for pulmonary tuberculosis were negative. January, 1921 he noticed a sense of weight in the left chest, with sharp kinking pains. February 29th, March 7th, and March 12th pericardial aspirations were performed (elsewhere) and a total of 2500 c.c. of fluid withdrawn. At the first two aspirations the fluid was clear; at the third it had the appearance of pea soup.

Physical examination showed a limitation of the movements of the lower left chest and slight respiratory retraction at the apex, with obliteration of the cardiohepatic angle. The heart sounds were distant and rapid, but there were no murmurs or arhythmia. The veins of the neck were engorged and the face cyanosed on recumbency. The systolic blood-pressure was 108, the diastolic 88, and the pulse-rate 110. Roentgen examination showed the heart to be enlarged to 26 by 16 by 10 cm. (Fig. 615). An electrocardiogram showed evidence of myocardial degeneration. Eight teeth showed periapical infection; there was no evidence of focal infection elsewhere. A tentative diagnosis was made of tuberculous pericarditis with effusion, and pericardiotomy was advised.

May 18th operation was performed under local anesthesia. The incision was made over the sixth rib, the pericardium was opened, and about 2000 c.c. seropurulent fluid aspirated. The pericardium was explored for trabeculated cavities, but none was found. The patient did not experience pain when the unanesthetized pericardium was incised. The pericardium was 3 to 4 mm. thick, and both layers were covered with a thick coat of fibrin. The heart lay in the posterior portion of the sac. The pericardium and superficial wound were closed without drainage (Fig. 616). A specimen removed for diagnosis revealed tuberculosis (Fig. 617). Guinea-pig inoculation of the exudate gave a negative result.

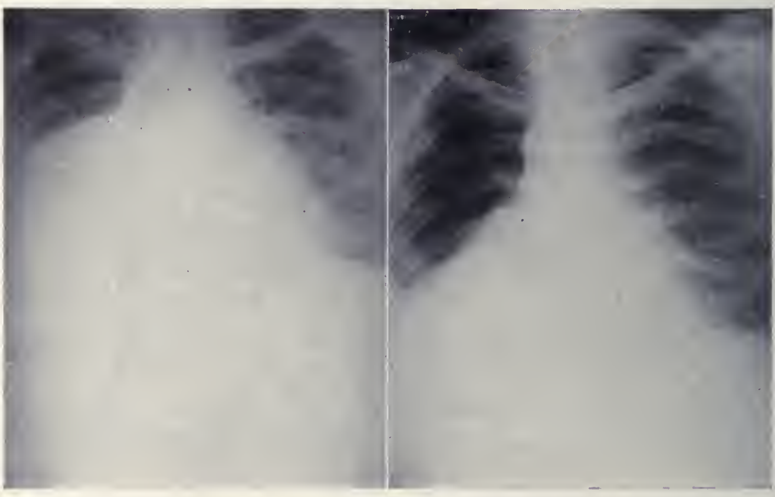
Fig. 615. Fig. 616.

Fig. 615.—(Case A358,127.) May 14, 1921. Very large heart shadow.
Fig. 616.—(Case A358,127.) May 23, 1921. Condition after pericardiotomy with evacuation of 2 liters of seropurulent fluid.

In July the patient returned to the Clinic for observation. He had gained 21 pounds since his operation, but he was still short of breath, any effort caused dyspnea, and the thrombophlebitis of the legs was still present. The area of cardiac dulness extended 4.5 by 13 cm., and the sounds were very distant, particularly at the apex; but there was no arhythmia, no systolic retraction, and Broadbent's sign was not present. A very large cardiac shadow could be seen in the roentgenogram. A pericardiotomy was advised.

August 3d operation was performed under local anesthesia and gas and oxygen analgesia. The intrapericardial pressure was measured with a water manometer and found to fluctuate with respiration between 4 and 12 cm. of water pressure. About 2000 c.c. seropurulent fluid was evacuated. The parietal pericardium and heart were covered with a whitish fibrinous membrane about 8 mm. thick, and the pericardium itself was about 4 mm. thick. Repeated observations during the evacuation of fluid showed no change in blood-pressure. The wound in the skin and subcutaneous tissues was completely closed by suture, but the pericardial incision, about 2.5 cm. long, was left open for dependent subcutaneous drainage.

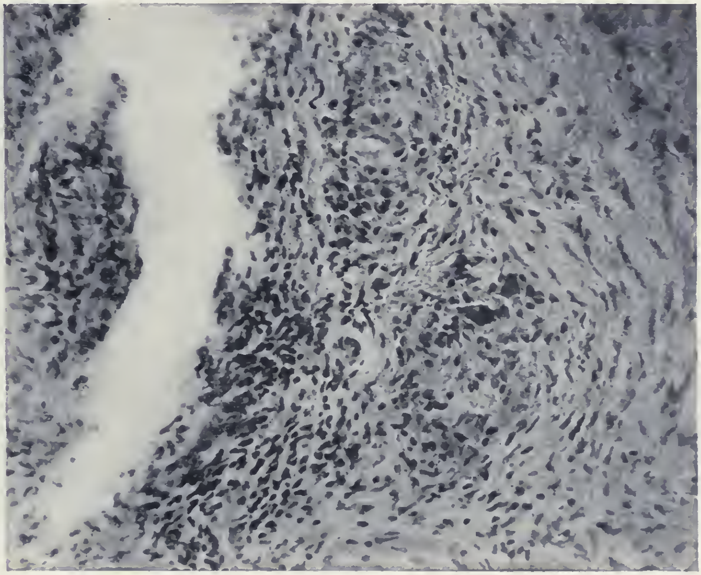

Fig. 617.—(Case A358,127.) Tuberculosis of the pericardium (× 250).

The patient's convalescence was characterized by a regular pulse-rate of about 90; a moderate seropurulent discharge from the wound, at first intermittent and then decreasing, which became purulent after one month; a left serous pleural effusion which developed about three weeks after operation, the roentgenogram revealing a collapse of the left lung; thrombophlebitis of the right jugular and subclavian veins, marked edema of the right hand and arm, upper chest wall, abdominal wall, and legs; and dyspnea and cyanosis.

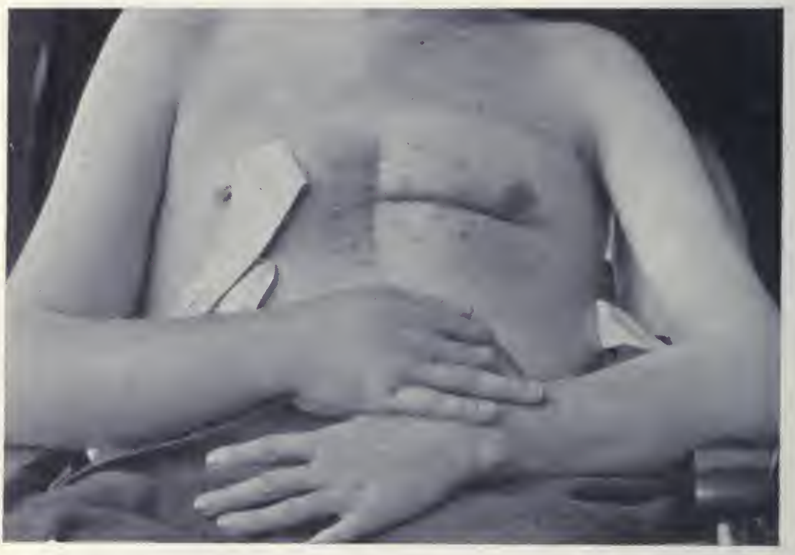

Fig. 618.—(Case A358,127.) September 10, 1921. Incision healed. Edema of the right hand and arm resulting from phlebitis.

September 1st, the twenty-ninth day after the second operation, thoracentesis was performed, and 700 c.c. of clear, serous effusion evacuated. The presence of pleural exudate obscured the Roentgen-ray findings, but as far as could be determined there was no marked increase in the pericardial effusion. The dyspnea, cyanosis, and general edema were considered due to myocardial weakness. Digitalis was followed by gastric upset, and little or no myocardial response; it was therefore omitted. A salt-free diet also was without apparent effect on the edema.

Cough without sputum and without obvious relation to other symptoms occurred in periodic attacks early in the illness. The patient left the hospital September 8th (Fig. 618). The outlook for recovery seemed rather poor.

DISCUSSION

The clinical diagnosis of tuberculous pericarditis, made by Dr. Willius in this case, was based on the chronicity, the recurrence of effusion after three aspirations, the history of recent exposure to tuberculous infection, and the absence of any other recognizable disease condition. The presence of a relatively large sterile effusion was also regarded as suggestive.

Differences of opinion have been expressed in the literature with regard to the relation of a large amount of exudate to tuberculosis. Rogers believes that a large serous effusion is characteristic of tuberculosis; Bertaux collected 12 cases of secondary tuberculous pericarditis proved at necropsy, in which effusions varied in amount from 1000 to 2200 c.c. Bérard and Péhu reported a case in which 2200 c.c. were aspirated, and emphasized the fact that the patient was able to walk about and was remarkably comfortable in spite of the large effusion. Musser and Ruschhaupt reported cases with about 3000 c.c. tuberculous exudate.

It seems probable that while a tuberculous exudate can and often does reach 1 or 2 liters, it does not follow that a large exudate may not be non-tuberculous, nor that an exudate of relatively small amount may not be tuberculous. The majority of cases of tuberculous pericarditis are of the adhesive type, without fluid.

Probably the reason that these patients tolerate a relatively large effusion when some patients have died from strangulation of the heart by a small amount of fluid (only 250 c.c. in Gluck's case) is that the chronic course has enabled the pericardium to stretch sufficiently to keep the intrapericardial pressure below the limit, causing serious embarrassment to the circulation. The presence of a large effusion with relatively slight disturbance from it, therefore, points to a chronic course; and tuberculous pericarditis with effusion is practically the only form that runs a prolonged, relatively symptomless course.

The effusion may be serosanguineous in the early stage, or it may be unmixed with blood, and rarely it is purulent from the onset. The blood is believed to come from the capillaries that appear in the organization of successive layers of fibrinous deposits (Virchow); in some cases it may come from ulceration of the visceral pericardium.

Judging from the relative frequency at necropsy of pericardial adhesions of probable tuberculous origin in patients who have died of another disease, it is probable that a large proportion of patients with latent tuberculous pericarditis recover spontaneously. Most patients with a large amount of exudate, however, run a chronic course and die. Surgical treatment is difficult. The fluid reaccumulates after aspiration. Open drainage is likely to be followed by secondary infection and the disease runs a characteristically downward course. In the case of secondary tuberculous pericarditis the course seems largely determined by the type and location of the primary lesion. Cases in which the primary condition is in the pericardium and which end in recovery cannot be positively diagnosed. In the cases of primary pericarditis herein recorded death was immediately due to the disease in 5 (Virchow, Meltzer, Marécaux, Noscov). In 2 (Scagliosi, Fromberg) death appears to have been the result of an associated non-tuberculous disease of the kidney. A single aspiration was performed in only 1 of these cases. In the case observed in the Clinic a pericardiotomy seemed indicated rather than a further pericardiocentesis, since the fluid had persistently recurred three months after repeated pericardiocentesis.

Open operation allows of complete emptying of the pericardial sac, which is probably always impossible by aspiration, owing to accumulation of fluid laterally behind the heart. This procedure affords an opportunity for evacuating trabeculated cavities, if such are present, and for obtaining a specimen of pericardial tissue for diagnosis. Further, there is the possibility that an open operation may prove curative in this condition, as a laparotomy often proves to be in a case of tuberculous peritonitis. The pericardiotomy in this case served to evacuate the exudate, and the diagnosis of the tuberculous nature was established by the microscopic examination of the specimen of excised pericardium. A very marked immediate benefit resulted from the operation, but it was ineffective in preventing recurrence of the effusion.

At the second pericardiotomy an attempt to secure drainage without the risk of secondary infection was made by instituting subcutaneous drainage after the method of Jacob. Study of the roentgenograms indicates that this procedure is at least partially effective. The collapse of the left lung may have been caused by an opening into the pleural cavity at the time of operation. No special precautions were taken to avoid this complication at the second operation, inasmuch as the opening was made in the same area as at the previous operation, following which there was no pneumothorax. At the first operation the pleuræ were found to be thickened and apparently adherent, and it seemed reasonable to suppose that further adhesions would result. Further, the absence of fluid in the pleural cavity for several days after the second operation is evidence that the pleural cavity was not opened at the operation. It is possible, therefore, that the pneumothorax may have developed from a lesion in the parenchyma of the lung. In any case the absence of symptoms attributable to pneumothorax at the time of the operation and the edema involving the right arm and neck, indicating a phlebitis of the jugular and subclavian veins, suggest that the patient's failure to improve may have been due in part to a dissemination of the tuberculous process. What part, if any, the absorption of a tuberculous fluid into the subcutaneous tissues may have played it is impossible to say. Subcutaneous drainage seems to be a less hazardous procedure than open drainage, which is almost sure to be followed by secondary infection. In the case reported by Jacob the cure followed closed drainage. In some cases cures follow open drainage (Meyer, Gibson, Rullier), but in most cases open drainage has been followed by death.

An alternative method of treatment that has been used with success has been the injection of air into the pericardium following aspiration of the fluid (Wenckebach, Weil, and Loiseleur). This method of treatment seems to offer the possible advantage of limiting the tuberculous exudate to the pericardial cavity, and is a prevention of later adhesive pericarditis. On the other hand, argument has been raised that the open operation mobilizing the chest wall by rib and cartilage resection, while not preventing adhesions, may nullify their possible harmful effect.

The complicating phlebitis of the saphenous veins early in the course of the disease is an argument against the supposition that the treatment in this case caused the later jugular and subclavian phlebitis. Richard described a case with involvement of the internal saphenous. Bérard and Péhu report a case with thrombosis of the right external jugular vein and swelling of the right arm. Manges had a case in which embolic hemiplegia developed three days after aspiration. At necropsy an area of softening was found in the lenticular nucleus. When the involvement of the myocardium, particularly the thin-walled auricles, is considered, it is easy to understand how an arterial embolus could be produced, but the mechanism of a venous thrombosis is difficult to explain. It may possibly result from the presence of bacilli in the blood-stream.

The question of the site for pericardiotomy has been fully discussed in a previous paper.[11] It might be added that because of the danger of opening the pleural cavity by an incision at the sternal edge, fifth interspace, xiphosternal approach might be advisable, as used in one case by Bérard and Péhu.

ABSTRACTS OF 8 CASES REPORTED IN THE LITERATURE SINCE 1897

Case I.—A man, aged eighty years, died of pericarditis with effusion. At necropsy the pericardium was found to be tuberculous, but there was no evidence of tuberculous involvement elsewhere (Virchow).

Case II.—A man aged forty-nine years had developed dyspnea, edema, and a pericardial effusion following exposure eight weeks before death. Necropsy revealed a double pleurisy with effusion, ascites, and a hemorrhagic pericardial exudate. The pericardium was tuberculous, but no other tuberculous lesions were found (Virchow).

Case III.—A man aged fifty-eight years, an inmate of an insane asylum, died suddenly of heart failure after a progressive loss in weight extending over a period of several months; there were no other symptoms. Necropsy revealed a greatly thickened "Perlsuchtsartige," nodular pericardium. The typical histologic findings of tuberculosis and a few *Bacillus tuberculosis* were demonstrated in these nodules, but there was no other evidence of tuberculosis (Meltzer).

Case IV.—A woman aged sixty years had had a clinical diagnosis of pyelonephritis. Necropsy revealed areas of hyperemia on the visceral pericardium and grayish tubercles in the circular sinus and along the origin of the great vessels. Microscopic examination of these tubercles showed giant-cells and a few *Bacilli tuberculosis.* The parietal pericardium was not involved. The mediastinal glands, bronchial glands, and those at the hilus of the lung were examined grossly and microscopically, in serial sections, but no evidence of tuberculous involvement was found. The cervical, axillary, retroperitoneal, and inguinal glands, the lungs, pleuræ, and other organs were also carefully examined for tuberculous involvement, with negative results (Scagliosi).

Case V.—A woman aged seventy-one years had had a clinical diagnosis of uremia, nephritis, myocarditis, hydrothorax, and pulmonary edema. Necropsy revealed a pericarditis with 600 c.c. turbid fluid, in which large numbers of *Bacilli tuberculosis* were demonstrated by direct smear of the exudate. The diagnosis was confirmed by guinea-pig inoculation. A most careful search anatomically failed to reveal any miliary tubercles, and microscopic examination showed neither giant-cells, tubercles, nor caseation. The author calls this tuberculous inflammation ("Tuberkelbacillenentzündung") and believes that the absence of characteristic tissue changes is due to a low-grade infection (Fromberg).

Case VI.—A man aged fifty-seven years died after an illness of five weeks, with symptoms characteristic of pericarditis with effusion. One pericardiocentesis with evacuation of yellow serous exudate had been performed. Necropsy showed a thickened pericardium with nodules containing areas of necrosis and giant-cells. The author concludes from the necropsy findings that this was a case of primary tuberculous pericarditis (Marécaux).

Case VII.—A man aged sixty-six years died after one month of illness, characterized by dyspnea and pain in the chest. Necropsy revealed an obliterative type of tuberculous pericarditis with 100 c.c. hemorrhagic exudate. *Bacillus tuberculosis* was demonstrated in the pericardium after prolonged search. The lymphatic glands were not enlarged and no tissue changes characteristic of tuberculosis were revealed by microscopic examination (Noscov).

Case VIII.—Jahn reports a case of pericarditis clinically diagnosed tuberculous, which was primary in the pericardium.

Fromberg states that Simmonds observed 2 cases similar to his own.

Numerous cases of tuberculous pericarditis with involvement of the mediastinal or bronchial glands are reported (McPhedran, Hanssen, Monnier and Durbin, Beréty, Kast, and others). Schrötter[33] reported a case in which a tuberculous pericarditis with myocardial involvement was associated with an old focus in the apex of the right lung.

Riesman reported as primary tuberculous pericarditis "in the clinical sense" a case in which there was found at postmortem beside the tuberculous pericarditis an old healed tubercle in the right lung.

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DEVELOPMENTS AND POSSIBILITIES OF THORACIC SURGERY

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In following the development of medicine and surgery from the earliest times one interested in thoracic surgery will be impressed by the fact that some of the earliest recorded surgical procedures were for wounds in the thorax. Because of the size and prominence of the chest as compared with the rest of the body and because it was recognized that a puncture wound in the chest was so rapidly fatal or so quickly incapacitated the victim, for centuries in close fighting the thorax has been selected as the most vital point to attack.

In the history of wars are recorded instances of a soldier whose lung partially protruded and the protruding part was excised or more often cauterized. Empyema following such wounds was recognized. Hippocrates described empyema almost as completely as it has been described up to the present time. Hermetic sealing of wounds in the chest was practised. Alexander the Great in the battle of Malli "blew air and blood from his chest wound" following injury by a spear, but recovered when the hole was sealed over. Galen cites a case in which part of the sternum was removed, the pericardium opened, and the pus swabbed out, and complete recovery followed. A high mortality from puncture wounds in the chest has been recorded throughout medical literature. The younger Larrey reports that most of the fatal wounds in Paris in 1830 were thoracic wounds. Intercostal stabs and cautery punctures for abscess of the lung have been recorded for centuries.

With the advent of general anesthesia and the use of antiseptics, and later the aseptic technic, surgery of all other parts of the body rapidly developed. Fear of pulmonary collapse and death undoubtedly accounted for the temerity of the surgeons in dealing with thoracic conditions. All efforts were directed toward the development of either a negative or a positive pressure apparatus which would insure the maintenance of lung expansion. Sauerbruch and his followers, on the Continent, and Willie Meyer, in this country, devoted years to perfecting a negative pressure chamber. Although Sir William Macewen almost twenty years ago pointed out that the lungs did not always collapse when the thorax was opened, and reported personal experiences in thoracic cases that should have greatly stimulated thoracic surgery, surgeons confined their thoracic work to conditions which were considered inevitably fatal unless some surgical measures were instituted.

It was a great pity, far beyond the imagination of all but a few, that surgery of the chest had not advanced as had surgery of other parts of the body at the outbreak of the Great War. Between August, 1914 and the late summer of 1916 thousands of young men died unnecessarily of gunshot wounds in the chest. Before the spring of 1916 in most surgical units in France the routine treatment, almost as carried on to the end of the war, had been established for gunshot wounds of the head, abdomen, joints, fractures, and, in fact, practically all parts of the body. There still remained a type of wound which all surgeons learned to dread, one which killed quickly or left the victim to die slowly of sepsis. For many months I watched men brought in with gunshot wounds of the chest; my unit had more than 80 beds for patients with chest wounds; 62,000 seriously wounded passed through the unit in five months; 19,000 in one month. One cannot readily forget the dread in making the daily rounds of the patients wounded in the thorax, consigning a certain percentage of them to morphinization and an easy death because we had not learned to help them surgically. In my unit not until July, 1916, and even late in the fall of that year, did we realize that approximately 73 per cent. of patients suffering from what we considered to be "necessarily fatal" wounds of the chest could be saved and restored to health, and in most cases to more complete usefulness and with less permanent disability than men suffering from wounds of other parts of the body, such as the abdomen, head, and joints, or from compound fractures of long bones. The development of this work has been reported in the literature repeatedly. I wish only to repeat that when it was realized that the thorax could be opened and explored and the contents handled with as little risk as that attending the manipulation of the abdominal viscera, perfection of technic was all that remained to bring thoracic surgery to the standard it has attained today. The war and the epidemic of influenza gave an extraordinary opportunity for thoracic surgery, and during that time it undoubtedly developed more rapidly than it had in all previous centuries. Cases I and II illustrate the development and possibility of thoracic surgery.

CASE I.—Lieutenant T., aged thirty-four years, was admitted to an advanced surgical unit February 23, 1917, eight hours after a bilateral gunshot wound of the chest; the missile had lodged on the right in the liver.

The respirations were 60, short and jerky. Pain was intense on both sides of the chest low down; the upper abdomen was rigid; a roentgenogram was not available. Examination left no doubt of laceration of the diaphragm on both sides. The patient did not respond well to resuscitation. Intense dyspnea and painful respirations were great contributing factors to the shock, and he was sinking rapidly. Operation and closure of the laceration of the diaphragm promised the only means of saving his life.

Under paravertebral anesthesia the left chest was opened first. The wound in the chest was excised and the incision extended in the interspace. A laceration 7.5 cm. long was found in the diaphragm on the left. The wound in the diaphragm was excised and sutured with catgut. A piece of shrapnel about 3 cm. long and 1.5 cm. in diameter was found embedded in the lower lobe of the lung, which was in about one-half collapse. The track and bed of the missile were excised *en masse* and the incision in the lung closed by suture. There was a large hemothorax. The pleural cavity was swabbed dry and the incision in the chest wall closed without drainage. The patient was placed in a semisitting posture, inclined somewhat to the right side, deep breathing was encouraged, glucose and sodium bicarbonate were given by rectum, and oxygen was administered through a mask. The patient was left on the operating table in this position for an hour and one-half. At the end of that time he improved remarkably, but he still complained of severe pain in the right side. The left lung expanded fairly well. After a paravertebral injection the wound in the right chest was excised; the right lung was in two-thirds collapse; a patent jagged opening in the diaphragm readily admitting two fingers was found. The wound in the diaphragm was excised and the incision extended so as freely to expose the upper surface of the liver. A track admitting one finger led to the missile at a depth of 5 cm. in the substance of the liver. The missile was removed, the track and bed of the missile thoroughly cureted and swabbed out with saline solution, then with ether, and the liver sutured with catgut. The wound in the diaphragm was closed with a single layer of fine chromic catgut sutures. There was hemothorax of about 500 c.c.; the pleural cavity was swabbed dry and the incision in the chest wall closed. The patient was returned to a partial sitting posture in bed, oxygen was administered, glucose was given by rectum, and sodium bicarbonate intravenously. The peculiar pain in the diaphragm was relieved at once by operation, and in eighteen hours the left lung was practically in total expansion, the right lung in about two-thirds expansion. The patient had an absolutely uninterrupted and easy recovery.

The type of wound in this case usually was fatal within from a few minutes to a few hours, so that the wounded man never reached a base unit, but usually died on the field of battle, in the advance dressing station, or in the casualty clearing station. By operation within from fifteen to eighteen hours after being wounded, 60 per cent. of the patients with such wounds were saved and ultimate recovery following a successful operation was complete and without any permanent disability.

Case II.—Gunner C., aged thirty-one years, was moribund on admission September 27, 1917, with a penetrating chest wound, extensive hemothorax, laceration of the diaphragm, liver, and kidney, and hernia of the colon.

Following active resuscitation—heater-bed, omnopon, intravenous injection of 600 c.c. of a 2 per cent. sodium bicarbonate solution, and glucose and sodium bicarbonate by rectum—he rallied slowly and a blood transfusion of 600 c.c. was given.

Six hours after admission the patient was taken to the operating room; the pulse was 130 to 140, the systolic blood-pressure 85; respirations were rapid; the right chest was not moving. It was thought that the patient was still bleeding. The entire abdomen was rigid. Just to the right of the body of the third lumbar vertebra was a large entrance wound admitting three fingers, and over the costal cartilage of the ninth rib in the anterior axillary line was a dirty jagged exit wound admitting three fingers. The colon was herniated through the exit wound and presented a gangrenous patch almost 2 cm. in diameter and with an area of laceration 1.25 cm. in diameter. Paravertebral and local anesthesia were administered. The incision was made from the edge of the third lumbar vertebra to the cartilage of the ninth rib. The entry and exit wounds and the torn deep muscles of the back were excised *en masse*. The gangrenous patch in the large bowel was excised and the opening closed with Czerny-Lembert sutures of linen thread. The colon was replaced in the peritoneal cavity. There was a wide open laceration of the diaphragm 12 cm. long about 1 cm. from the parietal attachment. The lung was almost completely collapsed. The blood-clot was removed with a hand. The pleural cavity was swabbed dry. The diaphragm was sutured with chromic catgut. A laceration of the outer and lower border of the liver admitted three fingers, but the liver was not bleeding. The peritoneal cavity was swabbed dry and the peritoneum closed. The right kidney was found to be split beyond repair. The incision was closed except for a two-way catheter left in the pararenal space for forty-eight hours. The operation was carried out entirely under local anesthesia without any gas or oxygen; 500 c.c. of sodium bicarbonate was given intravenously at the end of the operation. Recovery was complete and uneventful. The lung was in almost complete expansion in less than forty-eight hours.

Empyema: Acute and Chronic.—With repeated aspirations during the acute period, the use, if advisable, of the trocar and cannula, and, when necessary, intercostal thoracotomy, the death-rate from acute empyema is almost nil. If acute empyema is properly handled, chronic empyema is extremely rare, and the proper treatment of the chronic type reduces the total death-rate to approximately 2 per cent. Mutilating operations such as the Schede and Estlander should be unnecessary, and re-expansion and complete function of the affected lung should be obtained.

Lung Abscess.—A much smaller percentage of cases of lung abscess are now considered surgical than formerly, but the operation when undertaken is more radical, more rational, and more likely to result in complete cure. The condition of the majority of patients suffering from lung abscess will clear up entirely if the patients are put to bed at once in the open air with postural drainage, and given alkalies to offset acidosis, glucose to maintain the glycogenic function, and forced feeding to maintain strength. An operation should be undertaken only after this treatment has been given a thorough trial. When operation is undertaken it should be as palliative as possible and yet sufficiently extensive to allow evacuation, proper drainage, and obliteration of the cavity. Lately the mortality in these cases has been greatly reduced and the ultimate result improved. Cases III and IV illustrate the nature of the disease and the result of treatment employed in these cases.

Case III (A360,675).—Mr. H., aged twenty-eight years, who registered in the Clinic June 7, 1921, had been ill for eleven weeks, during which time he had lost 40 pounds in weight. He had had hemorrhages for about two weeks and was pale and emaciated.

Examination revealed an enormous abscess of the lung involving the upper right lobe (Fig. 619). The temperature was 103° F. The leukocytes numbered 15,400. The pulse-rate varied from 112 to 120. There were signs of a large cavity in the upper lobe of the right lung with consolidation below.

The patient was put to bed in the open air; he was inclined to the right side, with ice-bags over the entire upper chest. He expectorated about 600 c.c. of foul-smelling, reddish-brown sputum a day. Forced feeding was instituted and he was given a glass of 5 per cent. glucose solution to be taken over a period of two or three hours, and 120 gm. of sodium bicarbonate in twenty-four hours. Hemorrhage of about 500 c.c. occurred on the third day after admission and on three other occasions in variable amounts within the next ten days. After the second hemorrhage an attempt was made to collapse the lung with oxygen, but the patient was so acutely ill that he could not be moved in order to have a roentgenogram made for the determination of the extent of collapse. His condition was so serious that transfusion was considered. His coagulation time of nine and one-half minutes was reduced to three and one-fourth minutes by the administration of calcium chlorid (10 c.c. of a 10 per cent. solution intravenously) on three occasions at intervals of from five to six days. The patient continued to spit up dark blood-stained sputum for four weeks. However, he did not have any further active hemorrhage and gradually improved in health

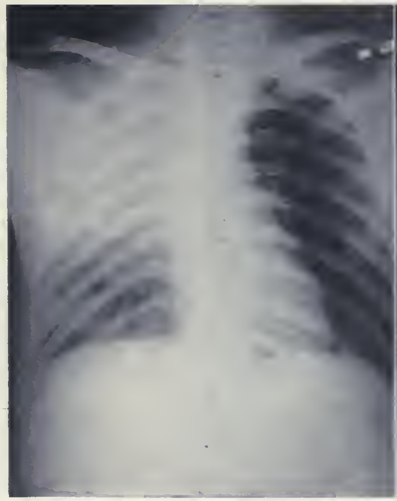

Fig. 619.

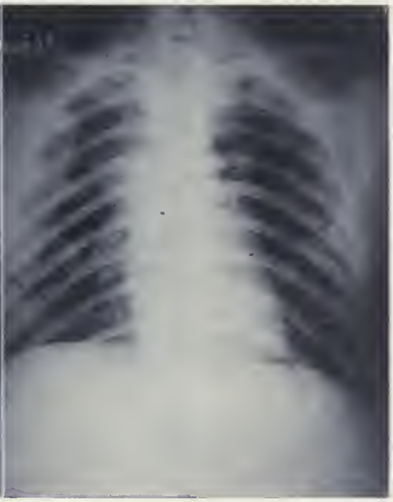

Fig. 620.

Fig. 619.—(Case A360,675.) Roentgenogram on admission, June 7, 1921.
Fig. 620.—(Case A360,675.) Roentgenogram on dismissal, August 1, 1921.

and was up and about by the middle of July. August 1st he was dismissed from our care entirely well (Fig. 620).

Three years earlier I would have considered this type of case urgently surgical. However, a patient with such an extensive abscess and so acutely ill belongs to the group in which the mortality rate following operation is high. Other cases similar to this have convinced me that well-controlled medical treatment should be tried out before an operation is undertaken. An interesting feature of this case is the development of a large pyogenic abscess without any demonstrable etiology.

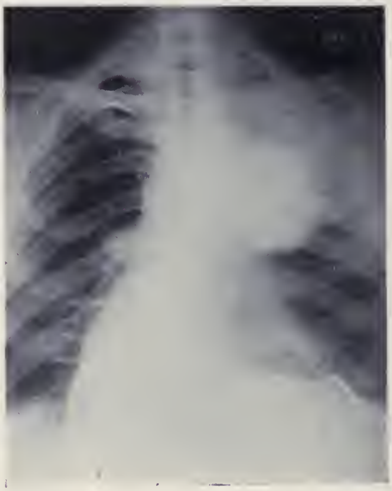

Fig. 621.—(Case A335,392.) Roentgenogram on admission, October 1, 1920.

Case IV (A335,392).—Mr. L., aged thirty-six years, registered at the Clinic September 27, 1920, because of the condition of his chest, which elsewhere had been diagnosed lymphosarcoma. Three months before coming to the Clinic he had had an operation in the eighth interspace for what had been considered an encapsulated empyema that had developed following pneumonia secondary to pleurisy; however, no pus was found.

Examination revealed that the patient had lost 50 pounds in six months, and was expectorating a foul-smelling sputum.

He had clubbing of the fingers and watch-crystal nails. He complained of pain in the right chest. His hemoglobin was 76 per cent.; the leukocyte count was 6400. Repeated examinations of the sputum gave negative results. The first roentgenogram revealed a shadow in the right upper mediastinum, probably of sarcoma (Fig. 621). The fact that since following the operation elsewhere the patient had begun to produce a good deal of sputum and had improved somewhat generally suggested either an encapsulated empyema or a lung abscess. The sharp outline of the shadow, however, the enormous loss of weight, the low leukocyte count, and the general aspect of the patient suggested sarcoma.

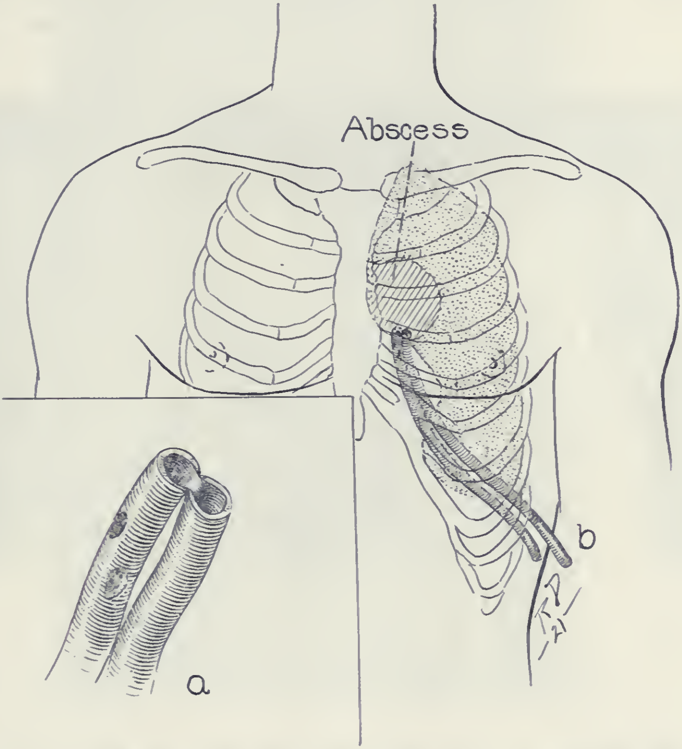

Fig. 622.—*a*, Two-way drain inserted dependent from the abscess cavity (*b*) in Case A335,392.

October 6, 1920 an operation was performed under paravertebral anesthesia. The old sinus from the previous operation was excised and found to lead up to a small pocket close to the mediastinum, to which the lung was adherent. The lung, which was adherent to the mediastinum throughout, was separated from its attachment so that a mass in the lung could be palpated. This mass at first felt like a solid tumor, but a small area of softening with fluctuation was found, and with my finger I managed to open into an abscess. Considerable pus escaped. A two-way catheter drain was left leading from the abscess (Fig. 622). The incision was partially closed. Much foul-smelling pus escaped through the catheter, but gradually diminished in amount. Two or three times a day a little saline solution was passed through the long end of the catheter merely to clear it. The patient was up and about a few days after the operation. November 19th he was discharged from the hospital, and two

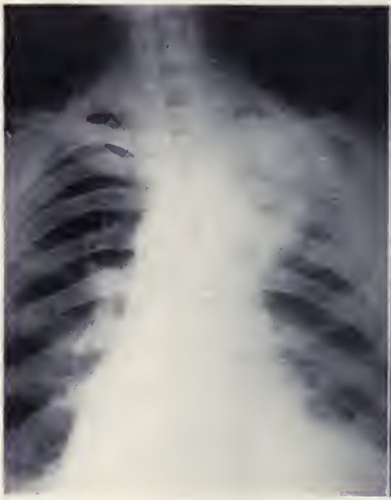

Fig. 623.

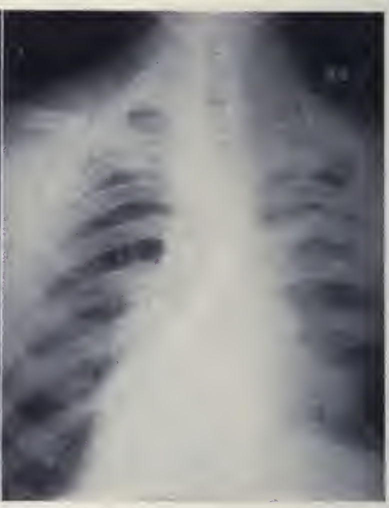

Fig. 624.

Fig. 623.—(Case A335,392.) Roentgenogram made two weeks after operation (Fig. 622).

Fig. 624.—(Case A335,392.) Roentgenogram on dismissal, December 4, 1921.

weeks later he was discharged from the Clinic entirely cured (Figs. 623–625).

This case illustrates the difficulty of an accurate diagnosis in such conditions and the value of an operation that is palliative and yet sufficiently extensive to secure adequate drainage. Had the condition not cleared up, I would have opened the chest in the fifth interspace, delivered the lung partially through the chest wall, fixed it there, and excised the lung tissue over the abscess wide enough thoroughly to expose the abscess, leaving it as a saucer-shaped cavity. The cavity would have been thoroughly packed with gauze, wrung out of 5 per cent. sodium

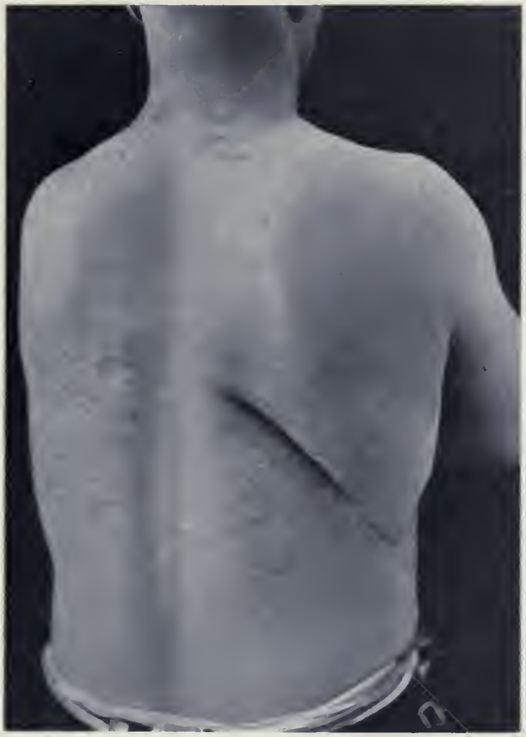

Fig. 625.—(Case 335,392.) The healed incision. The first incision, made elsewhere, was made too low to allow easy access to the abscess area. The scar was excised and the incision enlarged.

chlorid in glycerin, and an attempt made as early as possible to close it over with a pedicle skin-graft.

Bronchiectasis.—Patients with bronchiectasis seldom come for consultation early enough for surgery, and only after thorough medical treatment along the lines advocated for lung abscess should surgery be instituted. Partial pneumectomy is advisable in a few cases of unilateral bronchiectasis and artificial pneumothorax or manual collapse in a certain percentage. In bilateral bronchiectasis collapse of the more severely affected lung is the limit of judicious surgery. The best result is partial rather than complete cure.

Foreign bodies, whether in the pleura, lung, mediastinum, pericardium, or heart, can easily be removed. The localized sclerosis that surrounds most foreign bodies in the lung tissue often extends to become a diffuse sclerosis, very often involving an entire lobe. An area of focal infection may persist around the foreign body. Apart from the pathologic condition the majority of patients continue to worry about the presence of the foreign body. Although all patients may not have recurrent attacks of fever and the tendency to colds, chills, and so forth, I am convinced that the majority should be operated on.

Traumatic Lesions.—In the so-called "stove-in chest," whether or not there is traumatopnea, where there is marked respiratory distress, severe pain complicated with hemothorax, evidence of rough jagged portions of ribs protruding through the parietal pleura, and lacerating or irritating the visceral pleura with each inspiration, surgical interference is advisable. Death from the shock and exhaustion from the gross bony lesion can be avoided by removal of comminuted bone and sharp spicules, and the long-drawn-out subsequent distress, even if the patient does not succumb to shock, is avoided. Laceration of the diaphragm may cause sufficient distress to be diagnosed and should be repaired through the thoracic route, unless there is a complicating abdominal condition which could not be dealt with at the same time through this incision.

Tumors of the Thoracic Wall.—Tumors of the thoracic wall are now being operated on more often than formerly, and more successfully. Resection of the underlying attached lung or pericardium is possible.

Thymus.—At least partial thymectomy is possible and may yet prove to be advisable in patients with exophthalmic goiter who have large persisting thymuses. In some patients suffering from exophthalmic goiter who die following ligation or thyroidectomy no cause of death is revealed by necropsy, but large thymuses are found. It is possible that partial resection of the thymus should be performed at the same time of or preceding thyroidectomy.

Purulent Pericarditis.—In cases of purulent pericarditis unless the pus can be aspirated readily, the patient thereby improved, it is wiser to open wide the pericardium through a left parasternal incision of the fourth, fifth, or sixth costal cartilages. The cavity should be swabbed out thoroughly with saline solution and then with ether, and closed without drainage. It is impossible to aspirate the pus over the transverse sinus, except by the dangerous procedure of posterior aspiration. Pus tends to accumulate in the pouch behind the heart, and no matter in what position the patient is placed for aspiration, the pouch over the sinus will retain pus.

Subdiaphragmatic abscess and high or deeply placed hepatic abscesses can best be emptied through an abdominal thoracic incision if the diaphragm is opened wide (Fig. 626).

Hernia of the diaphragm can be dealt with most directly and most satisfactorily through the thoracic route.

Spleen.—I am not sure that splenectomy cannot be performed more easily through a combined low intercosto-abdominal incision than through the abdominal route.

Carcinoma of the Cardia.—Possibly a higher percentage of carcinomas of the cardia, which at present are considered inoperable because of their high position, may be dealt with through a combined abdominothoracic incision.

Carcinoma of the Esophagus.—A certain percentage of the cases of carcinoma of the esophagus diagnosed early will yet come to operation through a thoracic approach. I believe that although resection and suture of the esophagus does not seem feasible except for a very limited annular growth, reconstruction by tube skin-graft, as Lilienthal recently demonstrated, is possible.

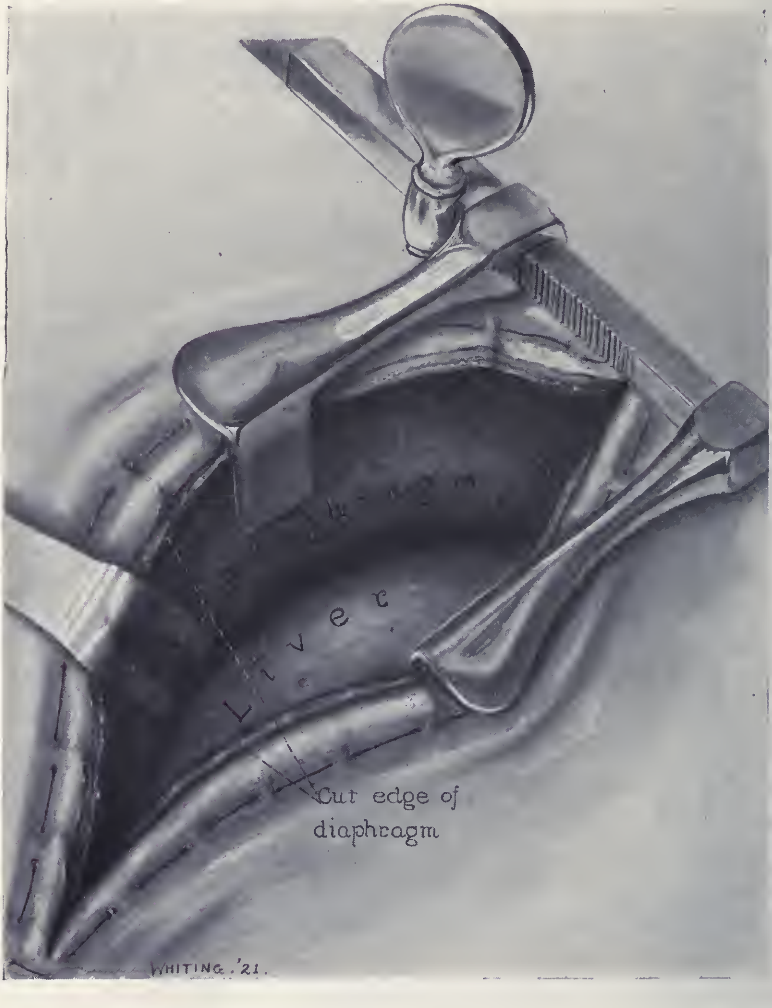

Fig. 626.—Retraction of the diaphragm, showing space between it and the liver.

Intrathoracic Malignancy.—Early diagnosis is all that is necessary for the assurance of some extension of life by operation in the cases of primary malignancy of the pleura and lung that occur often enough so that in the course of a year many come under observation in the Clinic. Lymphosarcoma elsewhere in the body responds so well to radium that it should easily be possible greatly to benefit and extend life in lymphosarcoma of the thorax or its contents. Beck recently reported and demonstrated a most interesting case of a young woman with sarcoma of the lung who had apparently been cured by direct application of radium after the chest wall over the mass had been removed. It is a simple matter to expose a mass anywhere within the thorax, and extirpation is easily possible unless the tumor surrounds the main vessels or the large bronchi at the hilus. I have opened many chests in which there were malignant growths, but in only 7 the chest wall, mediastinum, diaphragm, or pericardium were not involved by extension. I am now of the opinion that if a limited resection of the chest wall will clear the growth it should be performed if necessary in two or three stages. If on opening the thorax the deep supraclavicular glands show metastasis or there is fluid in the thorax, and certainly if the mediastinal glands show metastasis, further surgery, except for relief of symptoms, is contraindicated. Except in one case I have never done more than explore or remove specimens for diagnosis in the cases of so-called primary malignancy of the lung. Recently I have explored several patients in whom complete extirpation of the mass would have been possible had they come under observation a few weeks or months earlier, before metastasis and extension had occurred. I am recounting one of the patient's histories in Case V.

CASE V (A360,988).—Mr. H., aged fifty-one years, came to the Clinic with his wife June 10, 1921. The physician who examined his wife noticed that he spat a reddish sputum and advised him to be examined. He registered, and the only complaint he gave was that he had had blood-stained sputum for four weeks.

Physical examination of the chest did not reveal any abnormality, but in the roentgenogram was a vague shadow over the anterior surface of the left lung. On the basis of the roentgenogram and the blood-stained sputum a diagnosis of early primary carcinoma of the lung was made. The hemoglobin was 70 per cent., the leukocyte count 5200. *x*-Ray treatment was recommended and examination of the patient every two weeks. After seven weeks the shadow on the roentgenogram had extended and the patient was losing strength. An exploratory thoracotomy was advised.

August 3, 1921 intercostal thoracotomy was performed in the fifth interspace under paravertebral anesthesia. The incision extended from the costal cartilage along the fifth interspace to the postaxillary line (Fig. 627). The lung was not adherent to the parietal pleura. About 240 c.c. of yellowish-red serous fluid was found free in the pleural cavity. Although the chest was opened wide, the lung remained in complete expansion. The entire anterior medial portions of the upper lobe showed scarring and small nodular fibrosed areas here and there, with softening and degeneration. A large irregular mass already necrosed could be palpated in the lower and medial portion of the upper lobe. The visceral pleura was not adherent to the parietal pleura at any point (Fig. 628). None of the glands in the mediastinum was palpable. A specimen of the lung was removed for diagnosis. Because of the extensive involvement of the lung and the fact that necrosis was present further surgery was not indicated. The thorax was closed without drainage and aspirated at the end of eighteen, thirty, and forty hours, to the fourth day. The

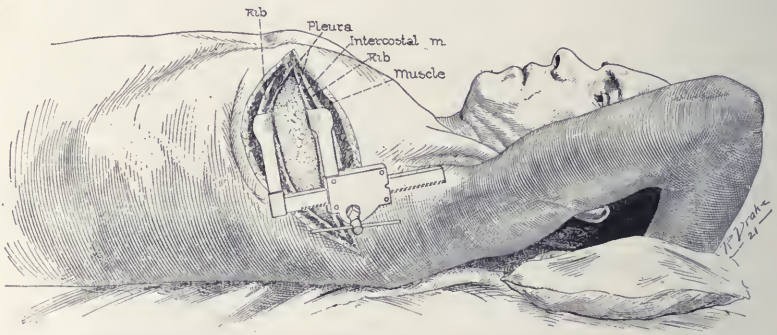

Fig. 627.—Incision for thoracotomy in Case A360,988; retractor in place.

second day the patient was out of bed, the third day up and about the room, and after the fourth day up and out of doors. The tenth day he left the hospital and went home none the worse for the operation. The pathologist's diagnosis of the specimen removed was carcinoma.

If in this case of carcinoma, which was found entirely by accident, operation had been undertaken earlier, before the growth had extended so diffusely through the lung and before necrosis had set in, resection of the entire cancer-bearing portion of the lung probably would have been possible. I am not sure that the *x*-ray treatment in this case was not harmful. The patient was opposed to radium treatment following operation. Until the effects of intensive *x*-ray treatment in such cases is more definitely determined I should hesitate to advise such

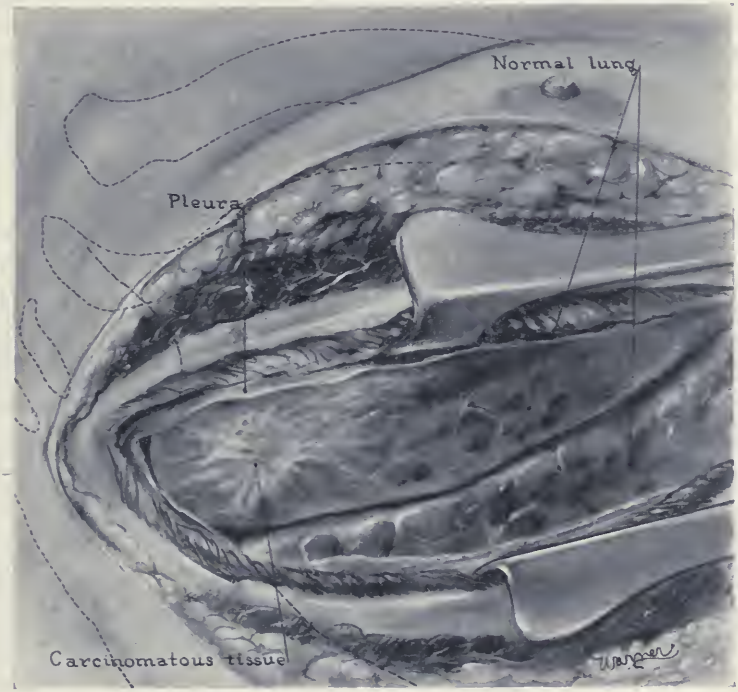

Fig. .628—Exposure of tumor in Case A360,988.

treatment previous to operation. I should prefer to open the chest and, if possible, remove the growth; if necessary, *x*-ray or radium treatment may be instituted later.

The extirpation should be attended by a prognosis for extension of life as good as radical excision of such a mass elsewhere in the body. I have removed a dermoid cyst of the lung and a cyst of the diaphragm which had been diagnosed cancer elsewhere. The patient with the cyst of the diaphragm had been advised that the mass was cancerous and inevitably fatal, and for five months had been living in dread of impending death. The mental relief in this case can be appreciated. In each of the 7 cases mentioned a carcinoma was confined to the lung itself, but it was so extensive and already degenerating and the patients so wasted and debilitated that only complete pneumectomy could be considered. Exploratory thoracotomy through an intercostal space is attended by an even lower mortality rate than exploration of the abdomen for undetermined carcinoma. Unless there is already evidence of metastasis, the thorax should be explored. Even in a certain percentage of cases, in which excision of the mass seems certain not to be feasible, palliative operation is indicated. In a certain number of cases a growth in the lung or pleura had extended to the diaphragm or pericardium, in the former case causing a deep constant pain with frequent vomiting, and in the latter a deep precordial pain, and at times a peculiar, unpleasant sense of pressure on the heart. In the treatment of such cases I have opened the thorax wide in an interspace and stripped the mass off the diaphragm or pericardium, as the case may be; if it was possible I turned the healthy lung over the raw exposed area and sutured it there, or manually collapsed the adjacent portion of lung so that it no longer came in contact with the raw area of the diaphragm or pericardium. All patients operated on in this manner experienced remarkable relief. One patient who had been vomiting for nine weeks did not vomit again. Patients with pain in the diaphragm have always been relieved, but in one or two with pain in the pericardium the pericardium was directly adherent to the parietal pleura, and this continued to cause some pain, but the peculiar distress from pressure was relieved. Although the life of these patients was not materially lengthened, they were made much more comfortable and did not die so painful a death.

With the increasing use of the *x*-ray throughout the country conditions within the chest, heretofore recognized too late, should be discovered and brought to operation while relief is still possible. I hope that I shall live to see the day when people will go to the physician every year or year and a half just as they go to the dentist, and that no examination will be complete without a thorough roentgenographic examination. When that time arrives operation for intrathoracic tumor will not be uncommon.

DIAGNOSIS OF THORACIC CONDITIONS

The value of a roentgenographic examination in thoracic conditions cannot be overestimated. Full-sized stereoscopic plates showing both sides of the chest and the diaphragm should be made. Movements of the thoracic contents and diaphragm can be determined only with a screen. The roentgenograms show the approximate amount of fluid and the presence of pneumothorax, the degree of collapse of the lungs, the position of the heart and mediastinum, the level of the diaphragm, the extent of bronchiectasis, the cavitation of the lungs, the presence of active or quiescent tuberculosis, metastasis, hematoma of the lung, the presence of foreign bodies, and the position and contour of a mass. Repeated roentgenographic examination is necessary during the progress of the case.

CHOICE OF ANESTHESIA

If for any reason one lung is partially or completely incapacitated anything which may endanger the air-bearing capacity of the other should be avoided. While bronchopneumonia is not a common sequel of general anesthesia, the stormy convalescence or the mortality rate to the particular person who contracts bronchopneumonia is 100 per cent. The postoperative retching, vomiting, and restlessness which frequently follow general anesthesia are better avoided in a patient who has had an extensive thoracic operation. If there were a simpler method of inducing anesthesia either of positive or negative pressure and thereby maintaining the lungs in expansion without ill effects from the anesthesia itself, I am sure that most surgeons would adopt it. Our nearest approach to the ideal is gas and oxygen, but so often it is necessary to add ether to secure sufficient narcosis. I have had no personal experience with the negative pressure apparatus, but I have given the positive pressure apparatus a good trial. Until some simpler means of maintaining anesthesia is found, I would urge that paravertebral anesthesia and, if necessary, some gas and oxygen during the manipulation within the chest, should be employed. Operation can be performed in the most serious cases with this type of anesthesia. An extensive, deliberate, and protracted operation can be carried on with the minimum risk to the patient. Respirations are deeper and more regular than with the general anesthesia and, to some extent, the movements of the lungs, mediastinum, and diaphragm can be controlled voluntarily by the patient, thus greatly aiding the operator. Ether and chloroform are contraindicated in surgery of the chest unless the lung on the side to be operated on is in expansion and adherent to the chest wall. The deductions of Graham and Bell from experiments on animals as to the size of the thoracic opening that is safe has no practical application to man. In operating on some hundreds of chests I have never had a case in which I believed that the large size of the incision was in any way responsible for the dyspnea that occasionally occurred. On the contrary, there is no doubt that a small opening in the thorax more often causes respiratory distress than a large one. I have never seen any alarming sequel following a wide incision in the chest wall. Whether or not the lung will collapse when the thorax is opened cannot be predicted. On the contrary, very often the lung seems to expand almost as if to force its way through the incision. Complete collapse is extremely rare; one-half collapse is usually the limit. In nearly 3000 patients operated on for lesions in the chest only 2 deaths have occurred on the table. One death was in a case of carcinoma of thyroid tissue implanted in the lung with an area of calcification about the large veins of the hilus; the patient undoubtedly died from massive air embolus. The second death was in a case of perforating gunshot wound of the aorta which I have previously reported, and death was due to extensive hemorrhage from the aorta itself. With patients under general anesthesia, even nitrous oxid and oxygen, I have been forced to hurry the closure not because of the dyspnea alone, but because one lung was more or less collapsed and the patient was not readily re-oxygenating the blood through the one functioning lung. I have never observed this condition with paravertebral anesthesia alone, which leads me to doubt whether any altered position of the heart or pressure on the opposite lung could be causative in producing the distress.

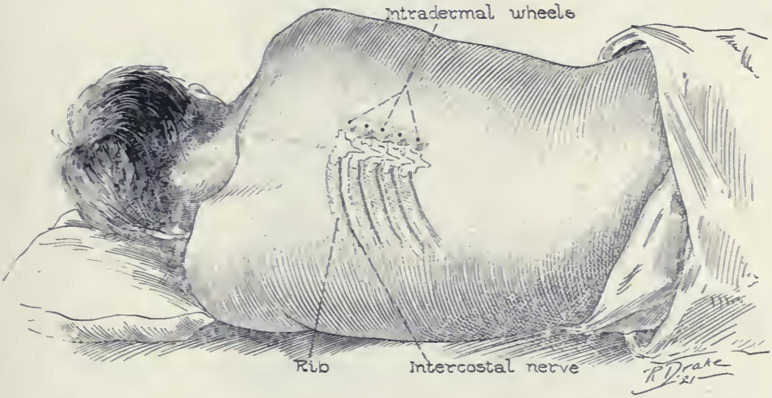

Fig. 629.—Points of paravertebral injection for thoracotomy.

The paravertebral anesthesia which I have employed for seven years is a simple infiltration of the nerves as they come out of the intervertebral foramina in front of the transverse process of the vertebra (Fig. 629). The needle should go deep enough to catch the sympathetic fibers as well, thereby rendering painless the manipulation of the intrathoracic contents. It is necessary to inject two or three spaces above and below the one to be incised. The injection of one side is, of course, sufficient unless extensive exploration of the mediastinum is contemplated.

Local infiltration well back from the line of incision is frequently combined with the paravertebral injection in order to overcome the delay of from fifteen to twenty minutes that is necessary for a purely paravertebral anesthesia to be completely effective. One per cent. novocain made up in normal saline solution and 0.25 per cent. potassium sulfate to which 10 minims of adrenalin to each 30 c.c. is added just before use is employed. One-half per cent. novocain is employed for local infiltration; $\frac{1}{300}$ grain scopolamin and $\frac{1}{6}$ grain morphin or one ampule of omnopon and scopolamin (Roche) are given one hour before operation. Gas and oxygen should be at hand should the patient become restless or the manipulation with the thorax excite a troublesome cough.

OPERATION

In operation for a thoracic lesion apart from empyema or lung abscess the absolute essential is rigid asepsis. Although the risk from infection is not so great as in operating on the abdomen, and although the pleura undoubtedly is more resistent to infection than the peritoneum, empyema following a simple thoracic operation is a grave sequel. A separate operating theater should be maintained for clean thoracic cases.

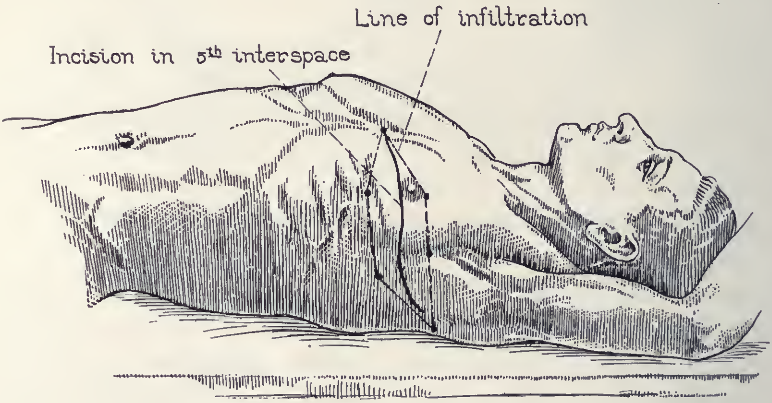

Fig. 630.—Incision with points of infiltration for operations on the chest.

The patient should be placed on the table with the side to be operated on dependent. A partial sitting posture is a good position. In most cases an intercostal incision of the fourth or fifth space extending from the postaxillary line to the middle clavicular line provides the easiest access to the thoracic cavity (Fig. 630). Of course, the incision must be so placed as to allow thorough examination of the part involved. Also it must be in such a position that easy access to the hilum of the lung and control of the large vessels is possible. Resection of ribs is rarely necessary. Occasionally it is wise to extend the incision

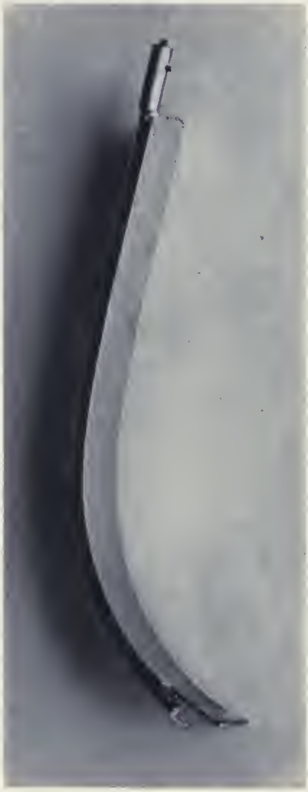

Fig. 631.—A convenient lighted retractor.

forward to the costal cartilages, and then through the costal cartilages above and below so as to give direct approach to the mediastinum or the hilum of the lung. By opening the thorax in the interspace unnecessary mutilation of the chest wall is avoided. Osteomyelitis and periostitis cannot result and the intercostal nerves and blood-vessels are not severed. A necessary precaution in intercostal thoracotomy is separating the parietal pleura from the rib above and the rib below the interspace and for from 3 to 5 cm. beyond each end of the incision planned in the pleura. This facilitates closure. A powerful retractor is required. A lighted retractor (Fig. 631) to inspect the cavity and suitable forceps (Fig. 632) for grasping the lung or

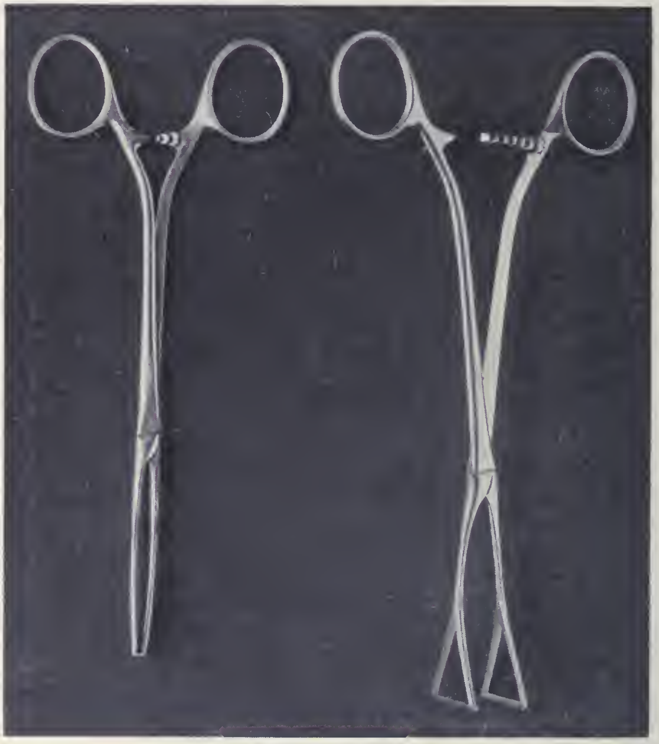

Fig. 632.—Large and small size of Duval's lung forceps.

mediastinum are necessary. The mediastinum and pericardium can be freely opened and explored, lung tissue can be incised without fear of hemorrhage, and resection of almost any amount of lung tissue is feasible. Care must be taken thoroughly to crush large bronchi and by suture to appose visceral pleura to visceral pleura. The diaphragm can be incised to any extent; on being sutured it heals like scalp. The thoracic incision should be hermetically sealed with the first layer of muscle sutures; otherwise pocketing occurs, serum accumulates, and the incision breaks down. Drainage of the chest should be avoided. It is curious just why fluid accumulates even after ordinary exploration. Aspirations at the end of eighteen hours, forty hours, and sixty hours are usually sufficient. Effort is not necessary to produce expansion of the lungs should they collapse, except just before tying the final sutures the patient should cough or hold his nose and blow, or a mask should be placed over his face, slight pressure exerted on the pomum adami to prevent air being forced into the stomach, and the lungs inflated with oxygen, or an ordinary nasal catheter may be passed, and the lungs inflated with a bulb. As a rule no attention need be paid to the lung. I have never known a lung that collapsed at operation to remain in collapse if the chest had been hermetically sealed. At the end of the procedure the patient should at once be supported in a semirecumbent position, inclined to the side operated on. He should be kept at rest in bed in the position he finds most comfortable, usually half-sitting. Oxygen is administered the first twenty-four hours if he is cyanosed. Morphin is freely administered to combat restlessness. Stimulants of all kinds are avoided, although, if the patient is an habitual drinker, brandy may be given. Routine aspiration is carried out. Physical signs are misleading and only by repeated roentgenographic examinations and aspiration can the chest be kept free of fluid. Unless there was a febrile condition prior to operation the patient should be out of bed early. He can usually sit up the second day, by the third day he can get up and move around the room, and by the fourth or fifth day he should be walking about.

As I have previously pointed out, in no other class of surgery is team work so essential to success. The surgeon, the physician, roentgenologist, and anesthetist should work hand in hand. The assistants and operating nurses should be quick and methodical, knowing each step in the operation and avoiding delay by having everything prepared in advance and at hand. Nurses who have had long experience in caring for patients postoperatively are the most important members of the team.

RETROPERITONEAL LIPOMAS: REPORT OF 12 CASES

JAMES C. MASSON AND EDMUND J. HORGAN

RETROPERITONEAL lipomas are so often unrecognized as such before operation or necropsy that we wish to present a group of 12 cases in which operation was performed in this Clinic, with the hope that they may aid the clinician and consulting surgeon to recognize this particular variety of retroperitoneal tumor.

Most of our cases of retroperitoneal lipoma and most of the cases reported in the literature were not diagnosed correctly before exploratory laparotomy was performed, but the surgeon felt justified in making the exploration in an endeavor to relieve the patient by removing the tumor, if possible. Exploration revealed a retroperitoneal tumor, but in some cases reported the true pathology of the tumor was unrecognized by the surgeon, who believed it to be a neoplasm in the retroperitoneum, and consequently inoperable. In some of the cases, contrary to the expectation of the surgeon, the pathologic process did not progress rapidly, or a benign lipoma was removed later at operation or necropsy. In most instances in which a retroperitoneal lipoma was recognized by the surgeon the tumor was removed. The tumor was removed in all cases in which operation was performed in this Clinic.

CLINICAL DATA

The average age of the 12 patients in our series was fifty-five years; the youngest was forty and the oldest seventy-two. Five were males and 7 were females. The average duration of symptoms was three years; the shortest duration was one month, and the longest ten years. In six instances the presence of the tumor had been noticed by the patient and a history

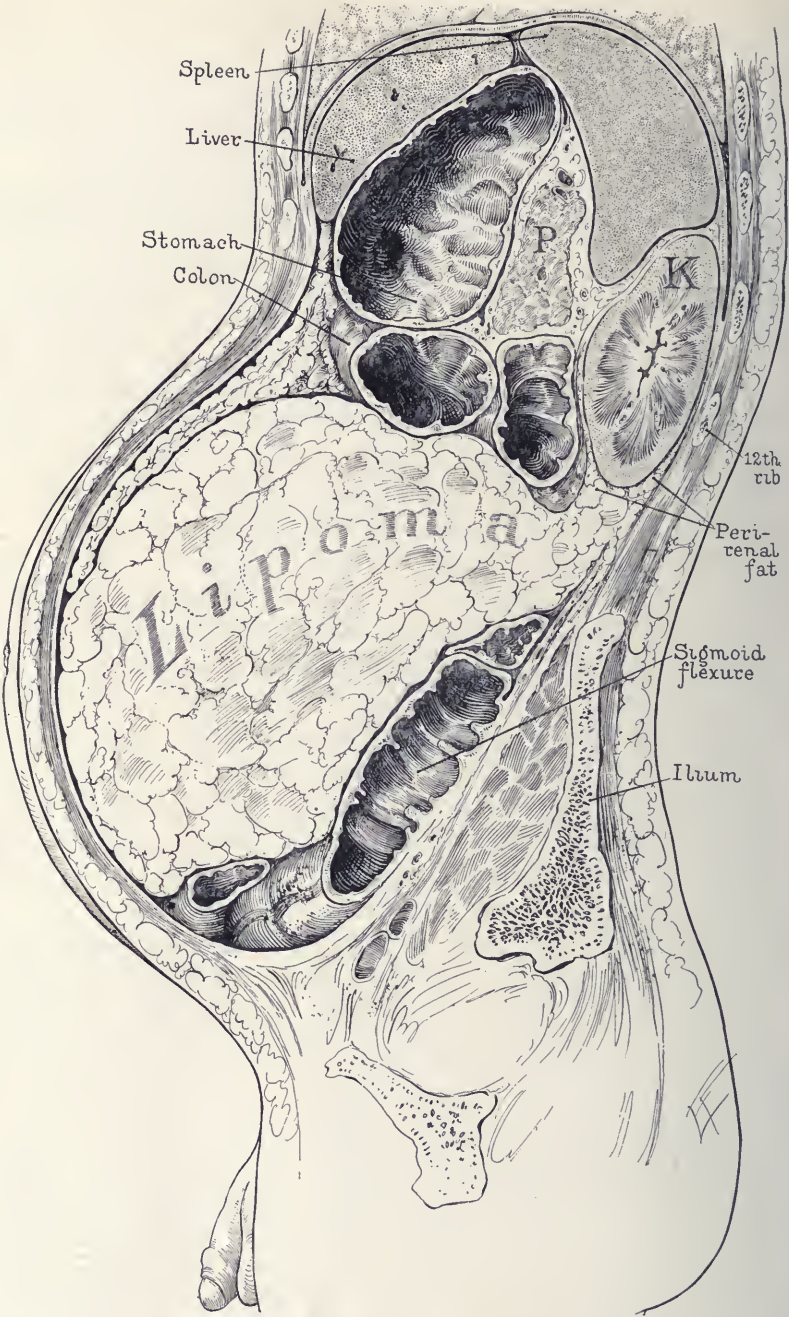

Fig. 633.—Section through the body left of the median line to show the relations of the lipoma to the abdominal organs in Case A228,249.

was given of a gradual enlargement of the tumor. In one case the growth had progressed slowly for seven years. In 6 cases the tumor had not been noticed by the patient; in 3 of these the tumor had been discovered by a physician and the patient informed of its presence.

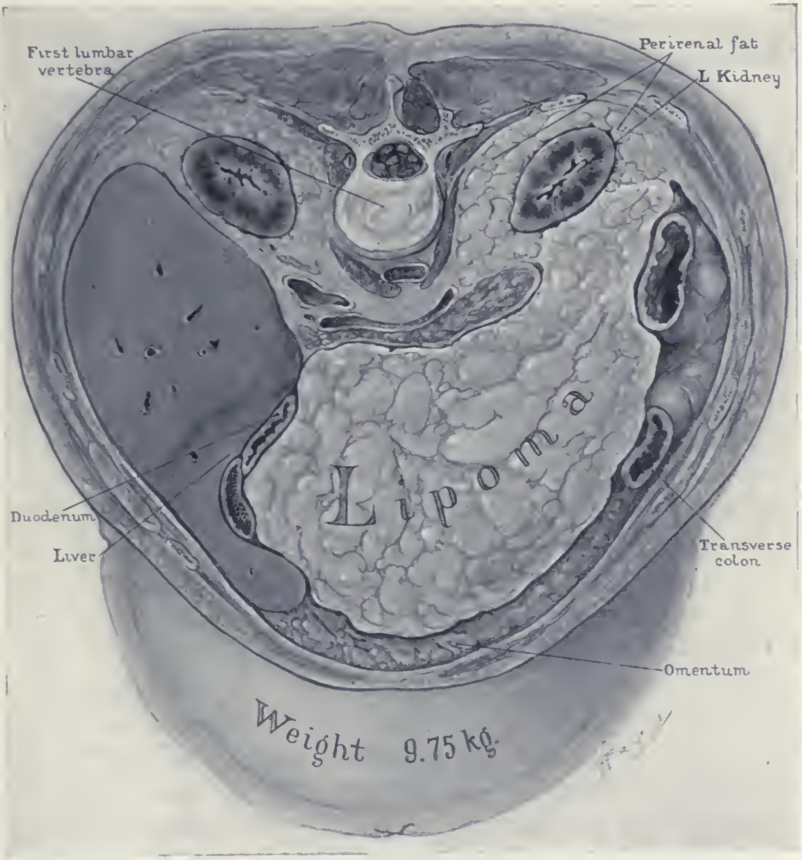

Fig. 634.—Transverse section through the body at the level of the first lumbar vertebra in Case A228,249.

Six patients complained of pain in the abdomen, and 2 of pain in the abdomen and back. Pain was severe in only one patient, in whom the lipoma was found to be degenerating. Six patients complained of food distress, with bloating and fulness. Two vomited; one patient had vomited blood occasionally for five years and at these times had passed tarry stools. Five patients complained of constipation, and one patient of diarrhea. Three patients had abdominal ascites. None had symptoms of intestinal obstruction. In a few patients with the increase in the size of the tumor the heavy mass caused a dragging sensation and inconvenience in stooping. Six patients had lost weight; the greatest loss was 50 pounds over a period of two years. The weight of the patient who had the largest tumor, 9.75 kg. (Figs. 633, 634), had remained stationary. Only 3 patients lost in strength. Three patients had frequency of urination. The only noteworthy pathologic findings in the urine were albumin in 6 cases, red blood-cells in 3, pus in 7, and hyaline casts in 1, but these changes were probably not due to the tumor.

Degenerating Lipomas (4 Cases).—These cases presented rather acute symptoms; a rise in the temperature, leukocytosis, weakness, sweating, loss of appetite, nausea and vomiting, and pain and tenderness with induration in the tumor and adjacent tissues. One patient (Case A291,541) was under observation for two weeks before operation while the tumor was undergoing degeneration and necrosis.

Case A291,541.—Dr. C. O. S., aged forty-eight years, was examined October 1, 1919. About one month before the patient had noticed a firm, smooth, freely movable ovid mass, about 8 cm. in diameter, in the left hypochondrium. The mass had increased considerably for three weeks and could be palpated in the lower left quadrant of the abdomen. The temperature had increased during the last week from 99° to 102° F. There was a dull aching pain in the back, and an uneasy sensation in the lower abdomen.

Examination revealed a large, solid, freely movable, tender mass in the left side of the abdomen, extending upward under the lower border of the ribs. The kidney could not be palpated. The percussion note was tympanitic because the tumor was covered by the colon. The leukocyte count was 7800. The Roentgen-ray study of the gastro-intestinal tract showed an extrinsic mass, and spasticity of the transverse colon over the tumor. Urologic examination proved the tumor to be extrarenal. A clinical diagnosis was made of "perinephric abscess (?), degenerating lipoma (?)."

October 8th the leukocyte count was 28,000.

October 13, 1919 operation was performed. The retroperitoneal tumor was found to be in two parts; they were removed separately. The larger mass was 25 by 15 by 8 cm., the smaller, 14 by 10 by 8 cm. The pathologist found an area of necrosis in the center of the smaller mass, and several such areas in the larger. He made a diagnosis of myxofibrolipoma, with a few fairly cellular areas.

DIAGNOSIS

In a study of these cases it was noted that relatively few symptoms accompanied these large abdominal tumors, and in most of the cases they were not sufficient to oblige the patient to give up work. Patients with lipomas undergoing degeneration and necrosis had the most marked symptoms.

The diagnosis of retroperitoneal lipoma is based chiefly on the presence of a palpable, ovoid, movable mass with a multiglobular surface which is fixed posteriorly. The patient may or may not be aware of the growth. The tumor is fairly firm, but on pressure it gives the sensation of a doughy mass. The consistency may vary in different regions, in some being soft and in others rather firm. One or more masses may be present.

The position of the tumor in the abdomen varies with its attachment and size. It principally is on the side from which it originates, and therefore the bulging is on this side until the tumor becomes very large, and the bulging of the anterior abdominal wall from the symphysis to the ensiform is uniform. The lower pole of the tumor may extend into and occupy part of the pelvis, and in this position be palpated through the vagina or rectum. The degree of mobility of the tumor is dependent on its attachment and the amount of fibrous tissue in the connective-tissue stroma. It may be attached over a large area, but the loose connective tissue of the fatty tumor allows it to be freely movable, and for this reason it may be easily mistaken for an intra-abdominal tumor. The clinical diagnoses in our cases are given in Table 1 (see pages 1462, 1463).

It is noteworthy that the percentage of error in the clinical diagnosis of retroperitoneal lipoma is very high. Morgagni cites a case from the records of Valsalva of a necropsy on a woman, aged sixty years, who had complained for many months of a tumor in the umbilical region "as large as the uterus in a pregnant woman can be." On opening the abdomen after death the base of the large tumor was found in the center of the mesentery, and connected with the adipose membrane of the right kidney. "The substance of the tumor was firm in some places, but in others rather soft, so as to resemble steatomatous matter."

The earliest case of retroperitoneal lipoma in which operation was performed was reported by Lizars in 1824. The woman had had an enlargement of the abdomen for nine years. At first her physicians considered her to be pregnant; later Lizars made a diagnosis of disease of the ovaries, and was urged by his patient to operate. Encouraged by the knowledge that ovariotomy had been performed successfully in America by McDowell (whom he refers to as Macdowal) he attempted to relieve the woman by an operation. However, he did not find the condition he had anticipated. The uterus and ovaries were perfectly sound, but there was a flattened tumor at the left sacro-iliac synchondrosis, lying beneath the division of the common iliac artery, which he refers to as "obesity of the intestines."

That retroperitoneal lipomas may be mistaken for tumors of the ovary, uterus, kidney, suprarenal, pancreas, spleen, and so forth, or for a pregnancy, is evidence of the difficulty of a differential diagnosis, but tumors of these organs, or pregnancy, should cause signs and symptoms, due to derangement of function, which would be sufficient to exclude them.

If a lipoma in the region of the kidney is small, or if it is of moderate size, and located in the perinephric tissues, it may easily be mistaken on palpation for the kidney or for a tumor of the kidney. Also, a large lipoma arising from the perinephric fat may cover the anterior surface of the kidney and form a mass so thick that the entire growth may be diagnosed tumor of the kidney. Urologic methods of diagnosis must be used to exclude such tumors as hypernephroma, polycystic kidney, hydronephrosis, and perinephric abscess.

Simple ovarian cysts should be differentiated by their spheric or ovoid shape, smooth surface, attachment in the pelvis, and consistency. They are tense, and do not give a doughy feeling on pressure. However, they resemble retroperitoneal lipomas more closely than any other tumor of the abdomen.

A large lipoma high on the left side may be mistaken for the spleen, but careful palpation showing the absence of a well-defined border with a notch should rule out the spleen. The tumor is less hard than the spleen in most cases of splenomegaly. The clinician will be aided by the blood-picture, but if the patient has had bloody stools over a long period, as in one of the cases in our group, the presence of a tumor with the blood findings of a secondary anemia may mislead the clinician.

Mesenteric and retroperitoneal cysts are so uncommon and the diagnosis is so obscure, that an abdominal exploration is necessary to clear up the diagnosis.

Magoun has reported finding retroperitoneal fibromyomas in the same location as retroperitoneal lipomas. Fibromyomas are much firmer than lipomas, but the symptoms they produce are as indeterminate as those of lipomas.

Retroperitoneal sarcomas in the abdomen that attain the size these tumors usually attain before they cause symptoms would be hopelessly inoperable. The sarcoma is very hard, firmly fixed to adjacent structures, and the patient is emaciated and cachectic. Lipoma may undergo sarcomatous degeneration, as in 2 of our cases, and if the patient is operated on before the malignancy has extended beyond the tumor mass he may be cured.

ETIOLOGY

The etiology of retroperitoneal lipomas, like lipomas elsewhere in the body, is unknown. Nothing could be found in the records of our cases of a possible cause, but it is of interest to note that in 2 of our cases the lipoma arose from the perinephric fat following an exploration of the kidney for stone and removal of the kidney. Two of our patients gave histories of injury, one due to a fall, the other caused by lifting.

OPERATION

Many of the cases reported in the literature were incorrectly diagnosed as tumors of the kidney, and some type of incision for operation on the kidney was made. In two of the operations in the Clinic the Mayo lateral incision was made. In both cases the tumor was small, and while no record was made of the steps of the operation, it is reasonable to suppose that the removal was difficult, since the tumors were located anterior to the kidneys, and the pedicles with the blood-supply were therefore the presenting parts of the tumors.

In deciding the type of incision to use, the important consideration is the attachment of the tumor and its relations to the blood-vessels. Generally it is easy to determine fairly accurately the point of attachment of small tumors, but often it is impossible to find the origin of larger tumors (weighing more than 6 or 7 kg.), since the abdominal viscera may be displaced and the tumor lying in the midline. In such cases a long transperitoneal middle line incision is advisable unless there is a definite history of the tumor having been palpable on one side only when it was smaller. If the tumor arises from either flank it will be found on opening the abdomen that the lateral part of the colon from that side is carried forward by the neoplasm, while the part of the colon on the opposite side of the abdomen lies behind. This was demonstrated in Case A228,249, in which the lipoma, weighing 9.75 kg., originated in the perinephric fat on the left side. The descending colon and sigmoid were found on the anterior surface of the growth, and the cecum and ascending colon were posterior in their normal positions. Most of the tumors originate in the perinephric fat and may be removed most satisfactorily through a straight rectus incision long enough to give satisfactory exposure. If the tumor originates on the right side the peritoneum forming the outer attachment of the cecum and ascending colon should be cut freely and the right half of the colon with its blood-supply intact should be rolled toward the middle line. After a small amount of properitoneal fat has been separated the capsule of the fatty tumor is exposed and, unless degeneration has resulted from interference with the blood-supply, it may be shelled out much like encapsulated lipomas in other parts of the body. If the tumor is located on the left side the procedure is the same, except that the descending colon is the displaced viscus. When degeneration has taken place and has extended to the capsule the procedure is much more difficult, since it is impossible to find a line of cleavage, and much dissection may be necessary close to and often surrounding such important structures as the renal, splenic, or mesenteric vessels, the ureters, and, on the right side, the second part of the duodenum. In some cases tongue-like projections may be found running between the spinal column and the great vessels, and if they are not well encapsulated and free from adhesions they may make the operation one of very serious magnitude. The blood-supply to the tumor itself as a rule is in a small pedicle which is easily secured after the tumor is entirely freed.

Removal of a tumor that is attached in the base of the mesentery close to the middle line presents unusual difficulties on account of its intimate relations with important vessels. In many cases the mass is divided into two or more apparently distinct tumors by deep grooves in which the vessels lie. Great care is necessary in these cases not only to avoid injury to the vessels but also to remove all the tumor tissue, as there is a marked tendency for such tumors to recur. One patient (Case A24,651) was operated on four times in the Clinic during eleven years, and lipomatous tissue weighing altogether 23.70 kg. was removed, on an average of 5.92 kg. for each operation. Another patient (Case A291,541) was operated on twice. At the second operation the recurrent tumor was found to be a sarcoma.

After removal of the tumor great care should be taken to make the field of operation dry, as bleeding from even a small vessel may result in the development of a large hematoma in the cavity. It is very desirable in such cases to close without drainage.

Probably the greatest postoperative danger in the non-infected cases is the development of intestinal obstruction, although we had no such complication in our 12 cases. To avoid this it is advisable accurately to resuture the opening made in the peritoneum and to leave as little raw surface as possible.

MORTALITY

The mortality should be very low in the uncomplicated cases, but in the presence of degeneration or infection the operation may prove to be very serious. There were 2 deaths among our 12 patients. In one patient an abscess in the center of the lipoma, which weighed 2 kg., communicated with a sinus in the back which had persisted since exploration elsewhere of the kidney on that side some months previously. The other patient had a small tumor weighing 205 gm., but it was very cellular and firmly adherent to surrounding structures as the result of degeneration. In the attempt to remove it several large vessels were cut and, although the amount of blood lost on the operating table was not considered excessive, the patient was much shocked by the operation and, in spite of transfusion, died the following day. Necropsy revealed the fact that bleeding had continued from a small vessel after the abdomen had been closed.

PATHOLOGIC FINDINGS

Most retroperitoneal lipomas have been found to arise from the anterior surface of the perinephric fat, but they may be found at any place in the retroperitoneum of the abdomen or pelvis and in the mesentery (see Table 1, pages 1462, 1463). The attachment is sessile and may diffuse itself into the fatty tissue from which it arises. By gravity a lipoma arising from the fatty tissue in the retroperitoneum of the abdomen may wander into the pelvis. Similar tumors are found in the omentum and properitoneum.

In 4 of our cases the lipoma was degenerating, and in these tumors areas of necrosis were found in the central portion of the tumor. They were soft and grayish. Two lipomas had undergone a sarcomatous change and one contained an area of degeneration which grossly appeared to be myxosarcoma.

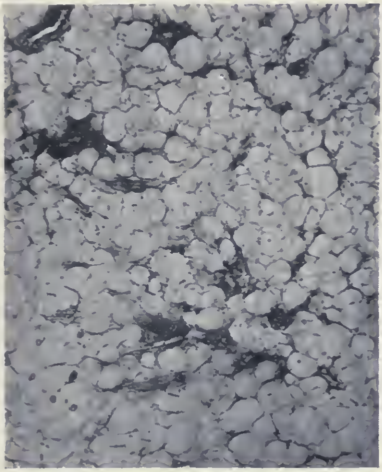

Fig. 635.—(Case A135,109.) Retroperitoneal lipoma; fatty area made up of fat globules in a loose connective-tissue stroma (× 50).

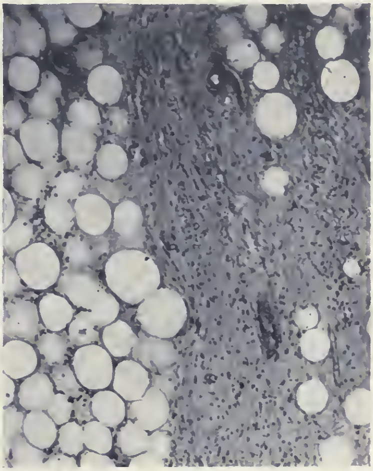

Fig. 636.—(Case A310,615.) Retroperitoneal lipoma; fibrofatty area made up of fat globules in a dense connective-tissue stroma (× 50).

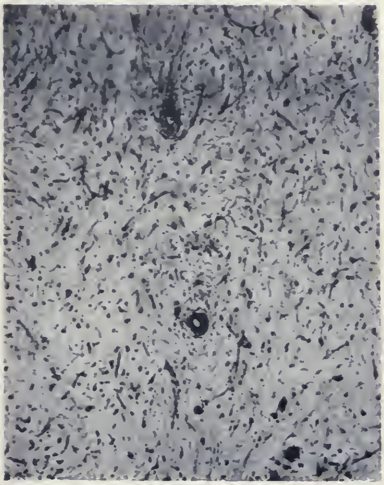

Fig. 637.—(Case A101,319.) Fibromyxomatous area in retroperitoneal lipoma (× 50).

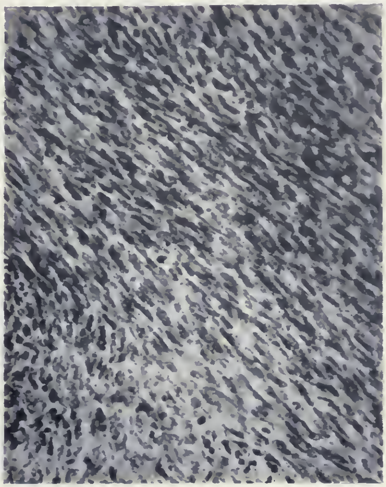

Fig. 638.—(Case A229,340.) Sarcomatous area in retroperitoneal lipoma. Many mitotic figures may be seen (× 100).

TABLE 1

DATA IN 12 CASES OF RETROPERITONEAL LIPOMA

Case. Date.	Age. Sex.	Duration of symptoms.	Clinical diagnosis.	Date of operation.	Attachment and location of tumor.	Weight or size.	Pathologist's diagnosis.
16,800 5/11/15	72 M.	8 years.	Abdominal tumor, kidney (?).	3/24/17	Perinephric fat in the right side.	10 cm. in diameter.	Lipoma.
A24,651 6/11/09	59 F.	1 year.	Ovarian tumor.	6/15/09	Perinephric fat in left side extending into mesentery.	8.98 kg.	Lipoma; the central portion necrotic.
			Retroperitoneal lipoma, recurrent.	9/24/12	Vicinity of vena cava in the right side.	2.30 kg.	Lipoma.
			Retroperitoneal lipoma, recurrent.	8/24/16	One mass posterior to the under surface of the hepatic flexure; one small mass in mesentery of the transverse colon.	7.40 kg.	Lipoma.
			Retroperitoneal lipoma, recurrent.	6/10/20	Growing from the mesentery down over the spine and around the great blood-vessels.	5.00 kg.	Lipoma.
59,126 9/20/11	56 F.	5 years.	Large multilocular cyst, ovary.	9/26/11	Growing from the mesentery of the small intestine and the fat around the right kidney.	3.00 kg.	Lipoma, degeneration.
77,008 12/5/12	59 M.	1 month.	Abdominal tumor, cecum (?), appendix (?).	12/12/12	Within the muscles in the right iliac fossa.	60 gm.	Lipoma.
134,482 6/28/15	56 F.	10 years.	Tumor of left kidney, cyst of the lower pole (?).	7/30/15	Back of the left kidney, extending into the transversalis muscle.	205 gm.	Fibrolipoma.
135,109 7/7/15	49 F.	5 years.	Splenomegaly, splenic anemia.	7/14/15	Region of the left kidney filling the upper left abdomen.	2.27 kg.	Lipoma.
157,257 4/12/16	40 F.	9 months.	Papillary ovarian cyst, 75 per cent. Tuberculous peritonitis, 25 per cent.	4/19/16	Anterior surface of the right kidney.	5.20 kg.	Myxofibrolipoma.
A228,249 4/17/18	51 M.	1 year.	Retroperitoneal sarcoma.	4/30/18	Perirenal fat on the left side.	9.75 kg.	Fibrolipoma.

229,340 4/27/18	61 M.	1 month.	Abdominal tumor.	5/14/18	Lower pole of the right kidney. Multiple small lipomas.	3.90 kg.	Degenerating myosarcoma, originating in lipoma.
A291,541 10/1/19	48 M.	1 month.	Inflammatory mass in the left side of the abdomen. (Perinephric abscess (?), degenerating lipoma (?).	10/13/19	Perinephric tissue on the left.	25×15×8 cm. 14×10×8 cm.	Myxofibrolipomas with some fairly cellular areas. Area of necrosis in center.
			Retroperitoneal lipoma, recurrent.	8/15/21	Below pole of the left kidney.	12 cm. in diameter.	Sarcomatous myxolipofibroma.
303,798 1/21/20	64 F.	7 years.	Retroperitoneal mass; pelvic tumor.	1/27/20	Left side of spine, just below the kidney.	236 gm.	Myxofibrolipoma.
310,615 3/29/20	42 F.	1 year.	Mass in the right side of the abdomen.	5/ 3/20	Right perinephric fat. Firmly adherent to old scar tissue where kidney had been removed.	2.00 kg.	Infected lipoma with abscess.

The size and weight of the tumors in the group we are reporting varied considerably: one weighed only 60 gm., while the heaviest weighed 9.75 kg. Hirsch and Wells reported one weighing 69 pounds.

Microscopic Findings.—In the fatty areas the sections show numerous large fat-cells, round or oval, and with a peripheral nucleus. Between the fat-cells is a fine, loose, connective-tissue stroma (Fig. 635). The amount of connective tissue varies in different lipomas and in sections from different areas of the same lipoma. Some areas are very fibrous, resembling fibroma (Fig. 636). In some of the tumors the fibrous areas are very cellular and show marked activity of growth. In two lipomas in our group the cells in these fibrous areas had become malignant, and presented the picture of a sarcoma (Figs. 637, 638). Sarcoma developing in lipoma has been reported by Schiller and others. In some cases the fibrous tissue is edematous and resembles myxoma. The blood-vessels pass through the connective-tissue stroma and are most numerous in the fibrous areas.

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THE TRANSPLANTATION OF FAT IN THE PERITONEAL CAVITY

FRANK C. MANN

FAT has been transplanted in the peritoneal cavity for several purposes, the most important of which are: (1) to prevent adhesions; (2) to patch an opening pathologically or surgically produced in some part of the gastro-intestinal tract; (3) to strengthen a suture line of the gastro-intestinal tract or the ureter; (4) to replace lost peritoneum; (5) to occlude a portion of the gastro-intestinal tract, and (6) to stop hemorrhage. The fatty tissue usually employed has been omentum in free and attached grafts, although subcutaneous fat has also been used.

In an attempt to evaluate the intraperitoneal transplantation of fat series of experiments extending over a considerable period of time have been carried out in the laboratories of the Division of Experimental Surgery and Pathology of the Mayo Foundation. The first series was performed by Dr. Gordon Bell in 1914, on the protection of a suture line of the ureteral anastomosis; the second series by Dr. Stuart W. Harrington, on the use of fat to protect the suture line of gastro-intestinal operations and its value in preventing hemorrhage from such organs as the liver, spleen, and kidney; and the third series by Dr. Thomas Kinsella, in order to determine the fate of the transplanted fat when used under various conditions.

For several years I have been carrying on experiments in which fat has been used in connection with operations for various purposes; at necropsy special note has been made with regard to the prevention or production of adhesions by the transplanted fat.

Considerable work has been done on this subject. The most important reports have been presented by the following authors:

Senn, Braun, Sundholm, Tietze, Enderlen, Loewy, Zilocchi, Girgolaff, Neumann, Neuhof and Wiener, Springer, Richardson, Sweet, Chaney and Wilson, Freeman, Corbett, Davis, Mayo, Finton, and Peet. In a careful review of their work a wide variety of clinical and experimental results and conclusions is noted. By anticipating somewhat our results we can, I believe, explain these contradictions. With regard to clinical data on the subject there do not seem to be any necropsy reports in cases in which the omentum had been transplanted. Because the patient did not develop symptoms referable to the transplantation the surgeon recorded the results of the procedure as good. Whether or not the results of the experimental investigations were good or bad seem, from our experiments, to depend on the individual variation in the reaction of the peritoneum and on the technical care in effecting the transplantation.

Our experimental work was done with two objects in view: the determination of the actual fate of the transplanted fat and the results produced, and the application of the procedure to clinical surgery. It is not enough that such a transplant remains viable or prevents adhesions; it must also give reasonable promise of being adaptable to clinical surgery in order to be of value.

As Williamson and I have pointed out, it is difficult to standardize experimental procedures in the peritoneal cavity because of the marked individual variation of the reaction of the peritoneum. For practical purposes, therefore, we carried out our observations on the effect of intraperitoneal transplantation of fat in connection with a large number of operations for the primary purpose of other investigations. In this manner we have relied for our conclusions on a large number of observations under various experimental conditions and following a varied technic.

FIRST SERIES: THE USE OF FREE TRANSPLANTS OF OMENTUM IN THE PERITONEAL CAVITY

To Prevent Adhesions.—Free grafts of omentum were used under many experimental conditions in order to prevent adhesions in the peritoneal cavity. In general, the results were quite definite. In most instances in which the free omental graft was used to prevent adhesions more adhesions were found at necropsy than if a transplant had not been used. If, however, infinite care was used in handling the transplant, so that the delicate cells would not be injured, and in tucking in the edges so that none of the cut surface was exposed, it was found to be possible to cover a traumatized area so that few, if any, adhesions occurred.

To Patch an Opening in Some Part of the Gastro-intestinal Tract.—In some experiments an opening, made by the knife or the cautery into the stomach or intestine, was partially or completely sutured and the sutured area was covered by a free transplant of omentum. In these experiments very little evidence was obtained to indicate that the free transplant of omentum was of much value in preventing leakage into the peritoneal cavity from such an opening. Certainly the transplant was not so valuable as a careful closure by suture, and in order to fasten the patch securely and at the same time prevent it from producing too many adhesions as much time was consumed as in carefully suturing the opening.

To Strengthen a Suture Line of the Gastro-intestinal Tract or the Ureter.—After the completion of an anastomosis in the gastro-intestinal tract or in the ureter a free transplant of omentum was sutured over the line of anastomosis. In this case also such a procedure is of questionable value, and certainly in nowise compensates for the careful employment of the usual suture line. The transplantation of free omentum cannot be recommended in place of the second suture line of a gastro-intestinal operation.

To Replace Lost Peritoneum.—A free transplant of omentum is sutured over an area from which the peritoneum had been removed and carefully sutured in position, no cut edges being left exposed in the peritoneal cavity, replaces the lost peritoneum to a certain extent. Again, it should be emphasized that unless great care is exercised in transplanting the omentum, the adjacent organs will become adherent to the site of transplantation over a larger area than if the transplant had not been used.

To Occlude a Portion of the Gastro-intestinal Tract.—A portion of the gastro-intestinal tract, such as the pylorus, could be occluded partially by suturing in a free transplant of omentum.

To Stop Hemorrhage.—In some experiments following trauma to the liver, kidneys, or spleen a detached tag of omentum was packed into the wound. This procedure was successful in stopping the hemorrhage, and at necropsy the areas were found to have healed nicely, and certainly no more, if as much, damage had been done than if the hemostasis had been effected by other means.

SECOND SERIES: THE USE OF ATTACHED TRANSPLANTS OF OMENTUM IN THE PERITONEAL CAVITY

To Prevent Adhesions.—When the edge of the omentum not in any way detached from its blood-supply was loosely sutured over any traumatized area in the peritoneal cavity the omentum adhered firmly to the traumatized area, and thus prevented any of the adjacent organs from adhering also to this area. In this respect the attached omentum can be used to prevent adhesions other than those between itself and the traumatized area.

To Patch an Opening in Some Part of the Gastro-intestinal Tract.—It was proved quite conclusively that the attached omentum sutured over an opening in the gastro-intestinal tract was of great value in preventing leakage from the lumen of the intestine into the peritoneal cavity. While it is questionable whether such a method of patching an opening in the gastro-intestinal tract should ever be employed when it is possible carefully to suture the opening, it is of value to know that the omentum can be of service in closing such an opening.

To Strengthen a Suture Line of the Gastro-intestinal Tract or the Ureter.—Suturing the attached omentum over the suture line of the gastro-intestinal anastomosis greatly strengthened it.

To Replace Lost Peritoneum.—The attached omentum sutured over a denuded area of peritoneum prevented adhesions of other organs to this denuded area.

To Occlude a Portion of the Gastro-intestinal Tract.—Partial or complete occlusion was produced by suturing the attached omentum around a portion of the gastro-intestinal tract, such as the pylorus.

To Stop Hemorrhage.—The attached omentum packed into a traumatized area of the liver, kidney, or spleen produced complete hemostasis.

THIRD SERIES: THE USE OF SUBCUTANEOUS FAT

Subcutaneous fat was used in the same manner as omentum. The results from the intraperitoneal transplantation of subcutaneous fat differed very little from those obtained with the free transplant of omentum.

SUTURE MATERIAL

Our observations tend to show that fine silk is the preferable suture material to hold the omental transplant in position because it produces the least reaction. However, fine catgut carefully used is also satisfactory.

CONCLUSIONS

1. Our experiments seem to indicate that the free omental transplant has a very limited application in surgery of the peritoneal cavity. The greatest benefit from its use seems to be in stopping hemorrhage from a parenchymal organ. In this respect it seems fully as good as the attached omental transplant.

2. A free transplant of omentum in the peritoneal cavity may remain seemingly viable for as long as one year, and retain some, although only a small percentage, of its fat. In many instances, however, after a few weeks the transplant is reduced to an almost fat-free scar-like tissue.

3. By exercising great care it is possible to use a free omental transplant to prevent adhesions, but the value of such a procedure is greatly decreased by the fact that unless infinite care is exercised the results, in all probability, will be worse than if the transplant had not been used.

4. A free transplant of omentum is not safe for routine use in patching an opening of the gastro-intestinal tract.

5. While a free transplant of omentum may be of some value in reinforcing the suture line of a gastro-intestinal anastomosis, it does not compensate for the careful use of the regular method of suture, and probably is of no advantage.

6. A free transplant of omentum can be used partially to replace lost peritoneum, but the transplant is not so good as suture, and unless great care is exercised the results may be worse than if the area had been left denuded.

7. The gastro-intestinal canal can be occluded partially by a free transplant of omentum.

8. A free transplant of omentum packed into a wound of the liver, spleen, or kidney stops hemorrhage from the wound.

9. There is a wide range of possibilities for the use of the intact omentum in the peritoneal cavity, providing care is exercised that such use does not furnish a basis for future intestinal obstruction.

10. An attached transplant of omentum can be used to prevent adhesions, to patch an opening in some part of the gastro-intestinal tract, to strengthen a suture line of the gastro-intestinal tract, to replace lost peritoneum, to occlude a portion of the gastro-intestinal tract, and to stop hemorrhage of a parenchymal organ. Of course, it is understood that the use of such an attached transplant of omentum carries with it the potentiality of producing intestinal obstruction.

11. All the statements made concerning the use of the free transplant of omentum are equally true with regard to subcutaneous fat.

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ACUTE CONDITIONS OF THE ABDOMEN

VERNE C. HUNT

LESIONS of the abdomen may be acute, subacute, or chronic, according to the degree of severity and duration. An acute condition of the abdomen may be a sudden and severe exacerbation of a chronic lesion. Peritonitis may be chronic, as in tuberculosis of the peritoneum, and usually acute peritonitis is the result of an invasion of the peritoneum by pyogenic bacteria.

In the successful management of acute lesions of the abdomen diagnosis is of as great importance as in chronic or subacute conditions. Unfortunately, however, the urgent symptoms of acute lesions forbid employing the various diagnostic procedures and methods and their deliberate correlation applicable to the chronic lesions. The diagnosis must frequently be made hurriedly on a few symptoms and findings which quite uniformly are manifested in the acute lesions. A carefully elicited history and the physical examination often must furnish the data on which the diagnosis is made and the choice of the procedure determined. Pain, nausea and vomiting, hemorrhage, constipation or diarrhea, and increased temperature, subjectively, and facial expression, posture, the condition of the skin, pulse, rigidity, and tenderness, objectively, are the important manifestations in acute lesions of the abdomen.

Pain is the important symptom which often influences the diagnosis and procedure. Its location and manner of onset, its severity, radiation, duration, and relation to other symptoms must be determined. The sequence of tenderness, nausea and vomiting, temperature, and collapse is important. The character of pain, its location, and severity may be quite characteristic for certain lesions. The pain of acute pancreatitis and mesenteric thrombosis is usually terrific and often unrelieved by large doses of morphin.

Extra-abdominal conditions which so closely mimic acute abdominal lesions must be borne constantly in mind; most prominent among these are the referred pain of pneumonia, particularly in children, pleurisy, acute dilatation of the heart, gastric crisis of tabes dorsalis, herpes zoster, and spondylitis. Besides the extra-abdominal lesions with acute abdominal symptoms are acute abdominal conditions that are not surgical, of which lead-poisoning and acute gastro-enteritis, angioneurotic edema, purpura, and splenic infarct are examples. By careful history taking and examination such errors in diagnosis usually are avoided, at least the urgency of exploration is obviated and further investigation in questionable cases insured.

The history often shows that the acute lesion is an exacerbation or complication of a preceding chronic lesion. Acute perforations of gastric and duodenal ulcers are usually preceded by gastric disturbances, information concerning which, because of the patient's condition, it is often difficult to elicit. However, very often after operation, when the true nature of the disorder has been determined, it has been possible to obtain a history typical or at least suggestive of ulcer immediately before or some time before. More painstaking histories obtained from the patient or his relatives will show an increased frequency of previous digestive disturbances in cases of perforated gastric or duodenal ulcer than has been noted in the past. Some observers have noted such disturbances in few more than 50 per cent. of these patients. At times the history includes acute exacerbations with epigastric pain severe enough to require sedatives; these, in reality, have been perforations with protective localization from which the patient has recovered spontaneously. The residue of this is frequently seen at the operating table in cases of so-called chronic perforation on to the pancreas, inferior surface of the liver, or gall-bladder. As W. J. Mayo has pointed out, the anatomic surroundings of the gall-bladder are excellent for protection; the parietal peritoneum, the under surface of the liver, the transverse colon, and the omentum all combine to localize the contaminating material which may escape from the perforated viscus. Likewise, the duodenum and the lesser curvature and the posterior wall of the stomach are so closely associated anatomically with the inferior surface of the liver and the pancreas that, in the event of perforation of the ulcer, these structures serve as protection to the peritoneal cavity. In a review of 25 cases of chronic perforating ulcer of the stomach observed in the Clinic it was found that 17 had perforated on to the pancreas and 4 on to the inferior surface of the liver. Of 72 chronic perforating ulcers of the duodenum, 19 had perforated on to the inferior surface of the liver, 13 on to the gall-bladder and liver, and 22 posteriorly on to the pancreas.

Deaver and others have discussed the tendency for cholecystic, appendiceal, and pelvic inflammation to localize. The localization of acute disease of the gall-bladder occurs by the same means of protection afforded the duodenum. The biliary attacks so typical of gall-stone disease are usually the source of little concern from the standpoint of life and death of the patient when they are of short duration, and it is only with their prolongation, impaction of a stone in the neck of the gall-bladder, and resultant suppuration and gangrene that perforation is imminent. The residue and complications of perforations of the gall-bladder, which usually are at the neck of the gall-bladder as a result of gangrenous ulceration from stones, are found fairly often during operation in the form of fistulas into the duodenum or colon, or persisting subhepatic or subphrenic abscesses. The process usually is preceded by sufficient inflammatory reaction so that neighboring structures become attached to it and seal the perforation before contamination occurs. At times this results in the discharge of the contents of the gall-bladder into its neighboring adherent viscus and in a fistula into the duodenum or colon. Often the ulceration is toward the liver and results in the escape of stones and infective material into the liver. Spontaneous non-traumatic perforation of the gall-bladder with contamination by bile of the general peritoneal cavity is exceedingly rare. It has been observed in but 4 cases in 11,000 cases of gall-bladder disease in the Clinic. Subphrenic abscess and fistula into the duodenum and colon are more often met with. The extreme rarity of perforation of the gall-bladder and contamination of the general peritoneal cavity justifies treating symptomatically acute gall-bladder disease and deferring operation in most instances until the acute symptoms have subsided.

The differential diagnosis of acute pelvic conditions embraces acute salpingitis, acute appendicitis, rupture of an ectopic pregnancy, twisted pedicle of an ovarian cyst, and intestinal obstruction. In these cases also the patient's description of the attack, the information obtained by asking direct questions concerning previous attacks, menstrual disorders, exposure to infection, and determining the sequence of the manifestations of the onset, together with careful physical examination, including bimanual and rectal palpation, usually approach accuracy of diagnosis and form the basis of judgment of whether or not the condition is immediately surgical or is best treated conservatively.

Generally, by correlation of symptoms and findings a fairly accurate diagnosis of an acute condition of the abdomen can be made, but there are conditions in which no other preoperative diagnosis but "acute surgical lesion of the abdomen" can be made and the true nature of the condition revealed only on exploration. Of these, acute pancreatitis and mesenteric thrombosis are examples. If possible, differential diagnosis should be reached, for there are acute lesions of the abdomen that are best not subjected to immediate operation, among which are acute diseases of the gall-bladder and pelvic inflammation. In some cases of acute lesions of the abdomen operation must be performed not for the primary lesion, but for its effect, such as peritonitis following perforation of a viscus. At times it is difficult to determine the advisability of operation; the diagnosis may be quite certain, but the generally poor condition of the patient may contraindicate operation.

W. J. Mayo has called attention to the fact that in perforations of abdominal viscera, after contamination has passed into peritonitis, the most important factor is the peritonitis, and the so-called early operation is not related in time to when the surgeon sees the patient, but to the time when the perforation took place. Deaver has likewise stated that early operation refers to the stage of the disease and not to the time the patient is seen by the surgeon. The patient, at the time he is first seen, may no longer be suffering from the original lesion, but from its effect, such as peritonitis following perforation, hemorrhage of an ectopic pregnancy, gangrene, or toxemia from a strangulated hernia.

The effects on the peritoneum of perforations have been divided into the stages of contamination, of reaction, and of general peritonitis (W. J. Mayo). A very high percentage of patients can be saved if operation is performed in the stage of contamination, and a very small percentage if operation is performed in the stage of progressive peritonitis.

The stage of reaction may be spoken of as the stage of fatal improvement or betterment, in which the pain and acute symptoms may subside and, if the rigidity disappears, actual improvement may result. However, persistence of rigidity in the presence of apparent improvement indicates progression, and operation should be performed. Overlooking rigidity in apparent improvement leads to postponing operation and allows the patient to pass into the stage of progressive peritonitis for which operation accomplishes little or nothing. While an appendix usually does not rupture within twenty-four hours after the onset of symptoms, occasionally the entire peritoneal cavity is contaminated from perforation within such time, and when the abdomen is opened flocculent, cloudy fluid escapes. In most of such cases the patient recovers after thorough drainage of the abdomen before true peritonitis develops. The results are as good following operations for perforations of gastric and duodenal ulcers when operation is performed within eight hours. However, if the case has passed on to the stage of true peritonitis and resultant toxemia, little may be accomplished by operation, and it is often better judgment to treat expectantly, employing the Ochsner-Murphy method, in the hope that the infection may become localized, particularly in acute cholecystitis, pelvic infections, and late general peritonitis.

The question of the advisability of operating in acute conditions of the abdomen is not always easy to decide. Most of us some time have been called in to see a case of what appeared to be acute appendicitis with the classical symptoms and manifestations of the disease, and we have advised operation, at which an apparently normal appendix was found, and general abdominal exploration revealed no other cause for the symptoms; the patient recovered and had no further attacks. These early operations are justifiable, however, since in the majority of cases a pathologic condition is found. Many of the patients, if treated expectantly, would recover spontaneously, but a fair percentage would develop general peritonitis. Furthermore, operation performed on the preoperative diagnosis of appendicitis of only moderate severity occasionally leads to finding a ruptured ectopic pregnancy, perforated viscus, or volvulus of the intestine.

The detailed consideration of the treatment of the various types of acute conditions of the abdomen is hardly within the scope of this paper. However, a few of the general principles applicable to these conditions require particular emphasis. No non-traumatic acute lesion of the abdomen is so urgent as to justify waiving a painstaking history, careful physical examination, the examination of the urine chemically and microscopically, and an estimation of the hemoglobin and leukocytes in the blood. These procedures will immediately, by exclusion, remove some of the possibilities in the differential diagnosis, and automatically, with the consideration of the time element, classify the condition as immediately surgical or to be treated expectantly.

The element of time between the onset of the acute symptoms and the institution of treatment in itself is at times the sole guide in the choice of surgical or non-surgical methods. To consider an acute abdominal pain accompanied by manifestations of shock with a board-like abdominal wall a surgical condition irrespective of the consideration of the time between the onset and time that the patient is seen courts disaster, and is accompanied by a high mortality rate charged up to surgery and more destructive of life than the employment of non-operative methods in the selected cases in which the patient is no longer suffering from the primary lesion, but its effects. It is known that operations for acute perforations, including those of the appendix, within the first twelve hours or still within the stage of contamination, are accompanied by a low mortality rate and a high percentage of recoveries, while with the advancement of time beyond the twelve-hour period the percentages rapidly reverse, and operation after thirty-six hours in the stage of progressive peritonitis, marked by the distended "silent" abdomen, persistent vomiting, rapid thready pulse, and mental acuteness of the patient, is accompanied by a high death-rate and a small percentage of recovery. It is to these cases of spreading peritonitis that the Ochsner-Murphy method of treatment is particularly applicable and many times carries a patient through who would have succumbed to the slightest surgical intervention. Fluids given by rectum or subcutaneously, morphin in sufficient amounts to afford quiet and comfort to the patient, and the frequent application of hot packs to the abdomen has been the treatment of spreading peritonitis for years in the Clinic. It conserves strength and aids localization, for which the patient may often be operated on in forty-eight or seventy-two hours, or later, with safety and benefit.

Excluding control of intra-abdominal hemorrhage as a result of an acute intra-abdominal lesion, surgery accomplishes little in the advanced effects of the primary acute lesions of the abdomen and reacts to the discredit of the method which in itself is not at fault, but its time of application is responsible.

Among acute postoperative conditions are hemorrhage, peritonitis, and intestinal obstruction. The true peritonitis of hemolytic streptococcus origin is little benefited by drainage. At times, however, a low-grade peritonitis, of which recently we have observed 2 cases following vaginal hysterectomy, is benefited by abdominal drainage. One of these cases was due to a gas-producing organism with great extra-intestinal distention of the abdomen, which was immediately relieved by a small incision and insertion of drains. Postoperative paralytic ileus is often due to a low-grade peritonitis; in some of these cases enterostomy is a life-saving procedure.

Increased accuracy in the diagnosis of chronic abdominal lesions is due largely to the Roentgen ray, particularly in lesions of the gastro-intestinal tract, but in many conditions the diagnosis must be arrived at by correlation of symptoms and findings only, when as yet the surgeon cannot be assured that in a particular case there is but one lesion in the abdomen, so that an incision which facilitates the work of a preoperative diagnosis only should not be used. In operating for chronic lesions of the abdomen, coexisting lesions in the stomach, appendix, and gall-bladder are often found, and this reason alone is sufficient to make the McBurney incision a relic. Its present usefulness is limited to operations on the appendix in children and the drainage of abscesses and performance of enterostomy and colostomy in adults. The frequency with which multiple lesions are found in chronic conditions justifies an incision sufficiently large and located so that, in the absence of general contraindications, general abdominal exploration is facilitated. For the same reason such an incision is of equal importance in acute conditions of the abdomen in the absence of general peritonitis, and the general abdominal exploration usually should be made before the examination of the suspected lesion. In this manner a good view of the stomach and duodenum, gall-bladder, and intestinal tract, if necessary, may be obtained in addition to palpation. Much may be learned by palpation of the stomach, gall-bladder, spleen, liver, pelvic organs, and kidneys. Even though the ureters cannot be felt readily, the fingers in their passage over them will be arrested by the presence of a small stone which did not show in the roentgenogram. Finding associated lesions in the abdomen or correcting a preoperative diagnosis makes general exploration in acute abdominal conditions justifiable in the majority of cases.

Points as follows should be emphasized:

1. A painstaking history and careful physical examination in all cases will avoid operating in cases of non-surgical acute lesions of the abdomen.

2. Early operation, within the first twelve hours or during the stage of contamination following perforations, is followed by a high percentage of recoveries; later there is often reaction

during which the patient may still be operated on. In the stage of progressive peritonitis, with the distended "silent" abdomen, quick pulse, and mental alertness, operation accomplishes little or nothing and is often destructive to life that may be conserved by non-surgical methods to aid localization and conserve the strength of the patient until his condition is so changed that a late operation may be performed with safety and benefit.

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INCISIONS IN THE KNEE-JOINT

Melvin S. Henderson

The stability and efficiency of the knee-joint are sources of constant wonder when the structure of its bony components is considered. The absence of bony prominences and corresponding depressions requires a most ingenious system of ligaments. In making incisions in the knee-joint, therefore, the surgeon should possess a definite knowledge of the location of these ligamentous structures, especially when it is important not to interfere with function.

From the point of view of the surgeon the knee-joint may be considered as consisting of an anterior and a posterior compartment. The anterior compartment consists of the suprapatellar pouch and the part of the joint between the bones and beneath the patella. The posterior compartment is a smaller space, not so frequently of surgical importance as is the anterior. It includes the intracapsular portion of the knee-joint behind the posterior tibial spine and is bounded anteriorly by the condyles of the femur and posteriorly by the posterior capsule. Some of the more usual surgical conditions of the knee-joint are mechanical derangements due to fractured or torn semilunar cartilages, loose osteocartilaginous bodies, tuberculosis, the infectious arthritides, and bony ankylosis.

Although the crucial ligaments are the main support of the knee-joint, the muscular action of the powerful quadriceps extensor and the hamstrings is also extremely important. The internal lateral ligament is important, but cannot be demonstrated definitely at operation, and, in reality, consists of the entire internal capsule. On the other hand, the external lateral ligament is definite and is easily demonstrated, but is placed well back of the region where any of the incisions to be described are made.

ANTERIOR INTERNAL AND ANTERIOR EXTERNAL INCISIONS

The internal semilunar cartilage is quite often the cause of mechanical derangement of the knee-joint, and in the large majority of cases the condition is due to a fracture or a tear in the meniscus. In these cases the anterior internal lateral incision is preferred (Fig. 639). The knee, flexed almost to a right angle, hangs over the end of the table, the patient being in slight Trendelenburg position. The incision is begun opposite the upper end of the patella, more or less closely follows the curve

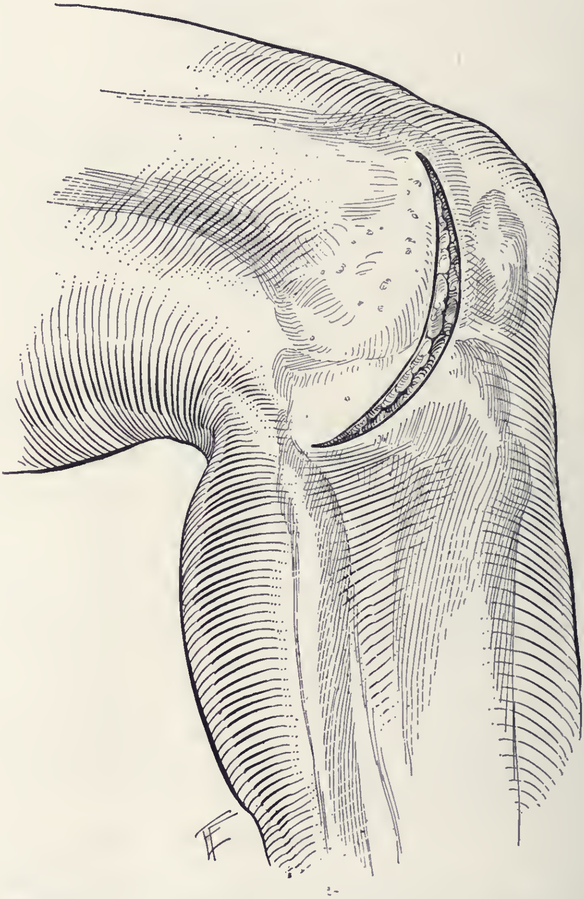

Fig. 639.—Anterior internal incision for removal of internal semilunar cartilage.

of the internal condyle, and is carried down over the joint line. The capsule may then be opened, and the internal semilunar cartilage examined, care being taken that no more of the internal capsule is cut than is essential to the proper examination of the internal semilunar cartilage. The anterior external incision (Fig. 640) is similar to the anterior internal lateral incision and is used for the removal of the external semilunar cartilage, occasionally loose. These incisions may also be used for

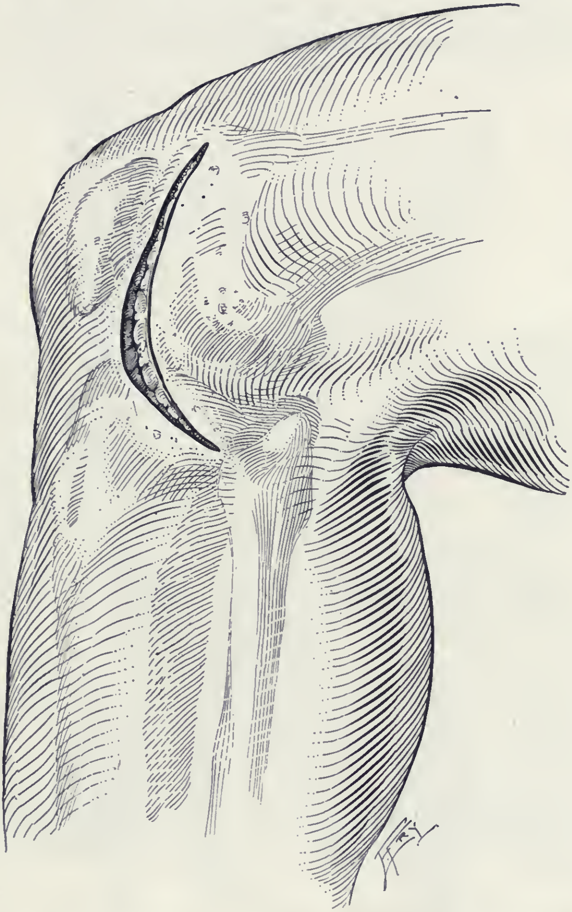

Fig. 640.—Anterior external incision for removal of external semilunar cartilage.

the removal of loose bodies in the anterior portion of the joint, but are somewhat limited in their possibilities for exploration.

SPLIT PATELLA INCISION

The split patella incision described a number of years ago by Corner is a long midline incision of about 15 to 20 cm. (Fig. 641). The patella is sawn through, the suprapatellar pouch opened, and the alar ligament or infrapatellar fat pad divided.

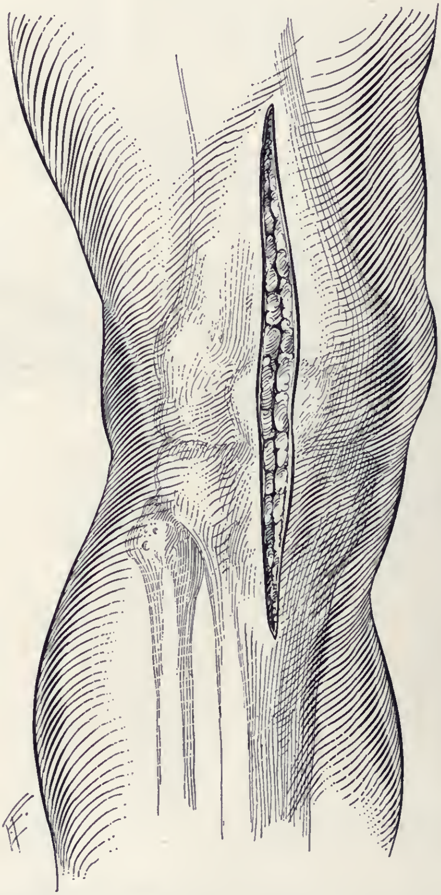

Fig. 641.—Split patella incision for search for loose bodies or repair of crucial ligaments.

By flexing the joint a splendid exposure of the anterior compartment is assured. This incision, however, is not so convenient for the removal of the semilunar cartilages as is the anterior internal or anterior external incision. When a thorough search for loose bodies or any repair of crucial ligaments is indicated this incision is the one of choice. The reaction following its use is surprisingly slight.

EXTERNAL POSTERIOR LATERAL AND INTERNAL POSTERIOR LATERAL INCISIONS

When the loose bodies are in the posterior compartment posterior lateral incisions are preferable to the incision described years ago by Brackett and Osgood. The knee is flexed to a right angle, thus relaxing the posterior capsule, and the foot of the table is not lowered as in the anterior incisions (Figs. 642, 643). The posterior lateral incision either on the inner or outer side, or both, offers an excellent opportunity for exploration

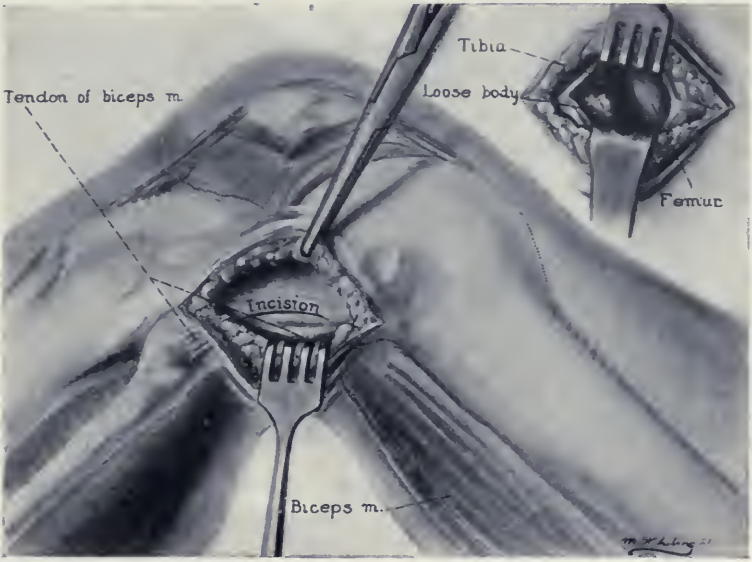

Fig. 642.—External posterior lateral incision. Insert shows loose body.

of the posterior compartment, since a view is obtained of the midline, but owing to the fact that there is a mesial septum which connects the posterior capsule with the tibial spine and crucial ligaments, posterior lateral incisions on both sides are often necessary. The incisions are small and inflict less trauma than do instruments forced through to the opposite side of the posterior compartment, as would be necessary if the entire posterior compartment were to be explored through one incision.

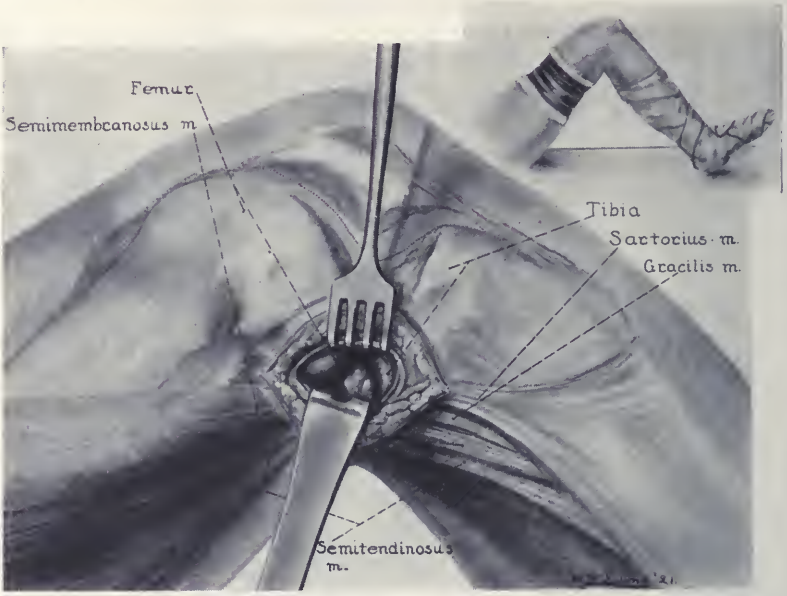

Fig. 643.—Internal posterior lateral incision. Insert shows knee flexed to the right angle and the position of the leg on the operating table.

If it is desired to drain a septic knee the internal or external posterior lateral incisions provide excellent drainage, but they should not be depended on to drain the entire joint.

If loose bodies can be palpated and definitely located, a small incision may be made anywhere in the joint. Under a local anesthetic a sharp needle may be forced through the skin, transfixing the body and thus holding it in position; the knee is carefully prepared and dissection carried down to the body.

INCISION FOR RESECTION OF THE KNEE-JOINT

For resection of the knee-joint excellent exposure is secured by a semicircular incision starting about on a line with the posterior border of the knee-joint and extending across to the same point on the opposite side, severing the patellar ligament (Fig. 644).

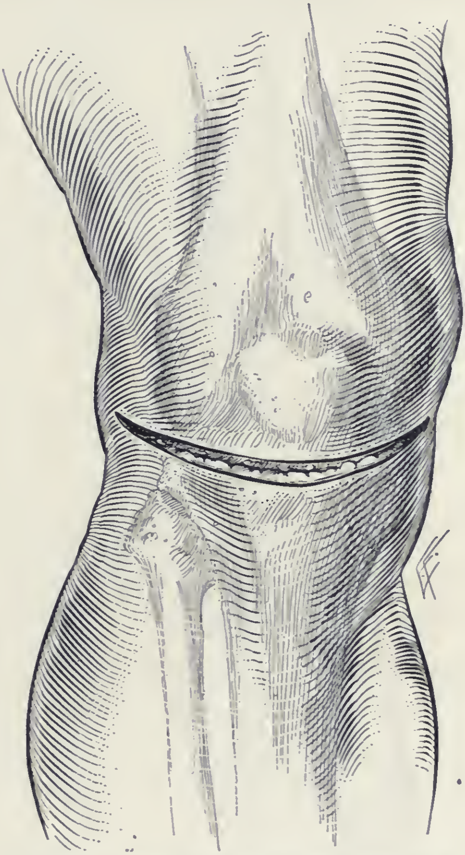

Fig. 644.—Incision for resection of the knee-joint.

INCISION FOR ARTHROPLASTY

Although arthroplasty of the knee-joint is rarely indicated, the recent work of Putti and Campbell emphasizes the fact that good results can be obtained. The incision described by Putti (Fig. 645), I believe, gives excellent exposure. It consists of a longitudinal incision in the midline extending upward from the patella for about 10 or 12 cm.; the incision is then carried on in the form of an inverted Y, running down each side of the patella to the joint line laterally. The patella is turned downward, the ligamentum patellæ not being molested.

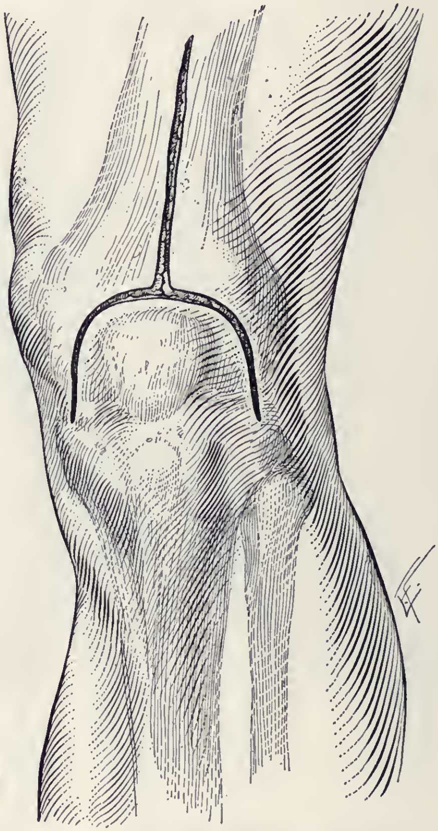

Fig. 645.—Incision of Putti for arthroplasty.

RÉSUMÉ

1. The anterior internal and the anterior external lateral incisions are the incisions of choice for exploration and removal

of the semilunar cartilages. They are also of use for limited exploration of the knee-joint, such as removal of loose bodies, tissue for examination, and so forth.

2. The midline split patella incision is of use when a free exploration of the anterior compartment is necessary or when repair of the crucial ligaments is undertaken.

3. The internal and external posterior lateral incisions with the knee flexed are the incisions of choice for the exploration of the posterior compartment, and afford excellent drainage for a septic knee.

4. The straight transverse incision across the patellar ligament is the incision of choice for resection of the knee-joint.

5. The inverted Y incision (Putti) with the arms reaching down each side of the patella is convenient in an arthroplasty.

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CLINIC OF DR. HENRY W. MEYERDING

I. Hemorrhagic Cyst of the Upper Left Femur.
II. Hemorrhagic Cyst of the Upper Right Femur.
III. Osteomalacia.
IV. Non-union of the Left Tibia Associated with Syphilis.
V. Periosteal Sarcoma Involving the Right Knee-joint.

CASE I (A219,836)

N. B., a boy aged eight years, was examined at the Clinic January 23, 1918. Six months previously the child had been kicked in the hip by a cow. He did not complain of pain afterward, but he limped at times. While skiing about five months later he fell, and a physician declared the leg had been broken. The child was taken to a hospital, where *x*-ray examination showed "a diseased condition of the bone." A definite diagnosis was not made, sarcoma, tuberculosis, and cyst being considered, and he was referred to the Clinic.

The examination showed enlargement of the left thigh, its circumference being 4 cm. greater than that of the right; there was no shortening. There was pain on deep pressure. The teeth were decayed and the tonsils and cervical glands were enlarged. The specific gravity of the urine was 1.019; the urine was acid in reaction and contained a few granular casts. The roentgenogram showed a large cyst of the left femur, probably hemorrhagic.

Operation was performed January 31, 1918. The cortex of the left femur was so thin and soft it could be cut with a knife. A large cavity about 11 cm. in length and 3.5 cm. in diameter, filled with a serous mahogany-colored fluid and some old blood-clots, was broken into. There was no distinct lining membrane. A diagnosis of hemorrhagic cyst of the femur was made (Fig. 646). The cavity was cureted and part of the cortex turned into it. The periosteum was sutured and the wound closed without drainage. The weakened cortex cracked a few days after operation, producing a green-stick fracture which, with the leg in a plaster cast, healed without shortening. No recurrence has been reported in three years.

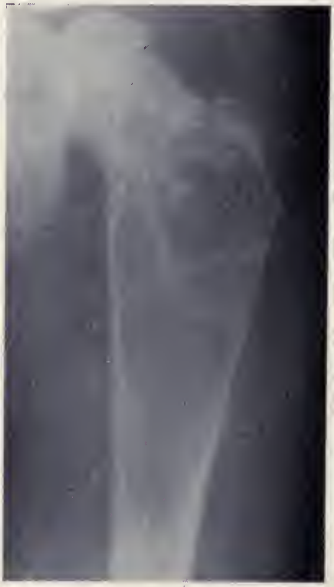

Fig. 646.—(Case A219,836.) Left femur. Cystic degeneration of the left femur (single). The medulla is enlarged and the cortex thinned. The trabeculations are not typical of osteitis fibrosa; they are heavier at the edge of the cyst and do not run out into it.

CASE II (A364,114)

M. G., a girl aged twelve years, was admitted to the Clinic July 8, 1921, complaining of pain in the right hip and upper thigh and difficulty in walking. There was a history of tuberculosis in the father's family. The patient's general health had always been good. Four years before she had fallen on the ice and sustained a slight injury to the upper thigh and hip. Tenderness over this area continued at intervals and she limped slightly at times. Two weeks before she had had a severe attack of sharp, stabbing pain in the upper right thigh, and was not able to walk for several days.

Physical examination revealed a well-developed and well-nourished girl. There was marked tenderness on pressure over the upper third of the right femur, with slight pain on moving the limb. Nothing abnormal could be felt and there was no limitation of motion at the hip-joint. No enlargement of the thigh had occurred and no shortening of the limb was detected.

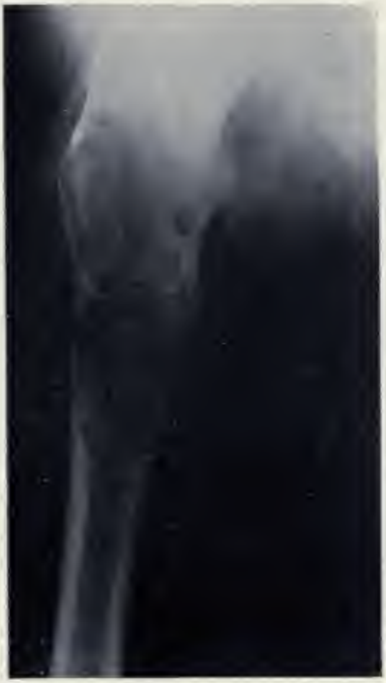

Fig. 647.—(Case A364,114.) Characteristic appearance of the hemorrhagic cyst in the upper third of the right femur. The irregular outline and rather clear center is due to the collection of fluid from the old hemorrhage.

Examination of the urine and the Wassermann reaction on the blood were negative. The hemoglobin was 60 per cent. and the leukocytes 10,300. The roentgenogram showed a tumor involving about 10 or 12 cm. of the upper end of the right femur, just below the trochanter and limiting itself to the medullary cavity. Roentgenograms of the other long bones were negative.

At operation the tumor was found to occupy the entire medullary cavity of the bone. The knife passed easily through the shell of bone, allowing a serous fluid to escape. The cavity was without trabeculation and lined with a smooth membrane which the pathologist reported to be inflammatory (Fig. 647). The patient was discharged with a figure-of-8 spica cast. The prognosis is good.

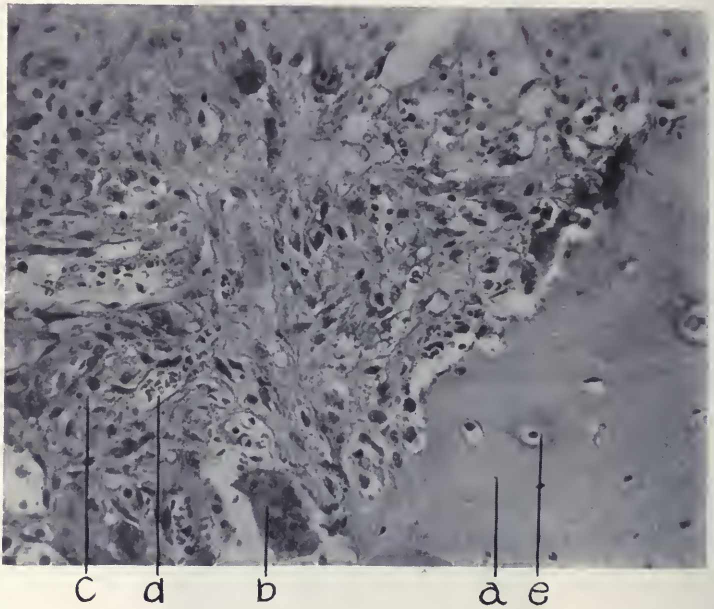

Fig. 648.—Specimen from a bone cyst in the right femur, taken on the edge of the cortex, showing (*a*) bone, (*b*) giant-cell (one found in four slides examined), (*c*) area of fibrosis, (*d*) blood-vessel.

Cystic disease of the long bones has a number of characteristic features. It usually appears before the patient is thirty years of age. It is always in the diaphysis. After a slow growth it appears to move upward and is most common in the proximal end of the shaft. If the cyst is single it usually arises from the center of the bone, and enlarges slowly at the expense of the cancellous bone, leaving a fairly clear line of demarcation. It does not cause thickening of the periosteum, and tends to grow away from rather than toward the epiphysis. The condition causes little or no pain, unless there is secondary infection, but limp, deformity, and fracture often occur. If the cyst becomes multilocular, it presents a series of translucent areas surrounded by striæ of irregular outline known as trabeculations. The cortex, being gradually encroached on, becomes thin or fused with the medullary substance, so that there are areas in which only the outline of the cortex can be made out. As the process continues the periosteum bulges out and may become irregular, but in these benign growths does not burst its bounds and invade the soft tissue, as is usual in the malignant growths. Later, the bone having lost its normal structure, it becomes weak and fractures on moderate trauma. The limb should be immobolized in plaster following operation. The history, clinical findings, and laboratory and roentgenographic reports should be considered in making a differential diagnosis of cystic disease of the long bones,[1] which in the past, unfortunately, has been confounded with malignancy (Fig. 648).

CASE III (353,061)

Mrs. M. M., aged forty-five years, came to the Clinic March 21, 1921. In 1910 she had begun having severe shooting, knife-like pain in the lower portion of the abdomen extending down both legs. She had noticed that since 1910 she had become about 2 inches shorter. For six years she had had considerable difficulty in walking.

Physical examination revealed a bowing of both femurs and tibias and stiffness of the vertebral column. A marked crease in the abdominal wall just below the costal margin was noted, the result of shortening of the vertebral column.

Roentgenograms of the pelvic bones and femurs revealed marked rarefaction. The tables of the skull were only slightly thickened. Osteomalacia and Paget's disease were considered for differential diagnosis; osteomalacia was favored because of rarefaction instead of eburnation of the pelvic bones and because of the apparently normal tables of the skull.

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[1] Meyerding, H. W.: Cystic and Fibrocystic Disease of the Long Bones, Amer. Jour. Orthop. Surg., 1918, xvi, 253–276; 367–382.

The case presents a picture long recognized as osteomalacia associated with pregnancy. The patient had been married at the age of sixteen years. She had had repeated pregnancies, had worked hard, and had had several illnesses, all of which may have a bearing on the condition. The altered calcium content in the osseous system, softening of the bone, with increase in size of the medulla, and thinning of the cortex are characteristic. The lower extremities bend, due to the weight of the body and the bone softening. The spinal column bows forward and the vertebral bodies crush under the supported weight. Often sharp shooting pains are complained of, and coxa vara, flat-feet, and other deformities occur. The patient becomes short in stature and the legs bow outward. Not infrequently patients observed early may be believed to have chronic infectious arthritis. Osteomalacia occurs in another type, such as is now reported in Europe, in undernourished males who have been compelled to work while being starved of lime, phosphorus, and vitamins. Unfortunately, curative treatment has not been found for these patients. They must be treated by supportive measures to maintain general health. Fractures apparently heal with very little callus; I have never seen non-union in one of these cases.

CASE IV (A369,228)

Mr. T. W. W., aged thirty-five years, came to the Clinic for examination August 19, 1921. He complained of non-union of a fracture of the left leg a short distance below the knee sustained in a fall from a building in 1916. He had worked in an iron foundry until the time of the accident; since then he had worked on a farm. He had not had previous illnesses and denied venereal disease. He had formerly drunk to excess, and in 1916 and 1917 he had used morphin, taking as high as 30 grains daily. He stated that he had not taken morphin since 1917. The fracture was reduced at the time of the injury; the overlying wound was closed by suture and primary union followed. The leg was placed in a fracture-box for three months and in a plaster cast for four months. After this crutches were necessary for a time and then a cane; the leg never seemed very solid. In 1917 his leg turned under him and he fell a few feet. Shortly after this a sliding bone-graft operation was performed on the tibia. The leg was in a cast for three months and crutches were used for four months. He then walked with a cane. Non-union resulted from this operation. The patient stated that he believed he had fractured the graft in his struggles while recovering from the anesthetic.

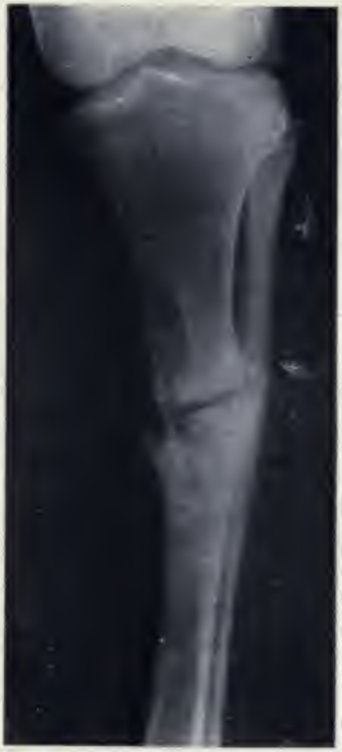

Fig. 649.—(Case A369,228.) A roentgenogram of ununited fracture Close inspection will reveal the layers of the bone-graft inserted elsewhere There is evidence of pseudo-arthrosis.

Examination revealed the bridge of the patient's nose to be slightly sunken and a perforation of the septum with healed edges. There were many scars over the arms and shoulders from hypodermic punctures. There was abnormal mobility in the upper third of the left leg and the entire weight of the body placed on this leg caused a tendency to outward and posterior bending. Roentgenograms revealed a fracture of the upper third of the tibia, with the fragments in good position, and a marked thickening and irregularity of the fibula. The Wassermann reaction was positive. The diagnosis of syphilis was confirmed and treatment for syphilis prescribed. A cast was applied to the leg and the patient was allowed to walk while receiving treatment for syphilis. This prevents deformity becoming exaggerated and union may occur without operative interference.

It has been our experience that non-union is not often caused by syphilis. In a large number of cases observed in the Clinic of non-union (400) syphilis was a negligible factor. The patient's statement that he fractured the graft in his struggle on awaking from the anesthetic demonstrates the necessity of perfect fixation in plaster following any operation in which the bone-graft is used. Failure of fixation is very often the cause of failure in these cases. Operations should always be deferred until treatment for syphilis has been carried to a point satisfactory to the syphilologist (Fig. 649).

CASE V (A367,850)

Mr. G. W., aged thirty-seven years, registered at the Clinic August 9, 1921, complaining of pain in the right knee. He had wrenched it in a jump from a wagon in 1903. There was no locking or swelling. Two operations had been performed without appreciable results. In 1919 he had contracted influenza, and the knee had become very painful and swollen. He was unable to extend the leg. A piece of cartilage had been removed from the knee, with only slight improvement. His knee became progressively worse and he was obliged to use crutches.

On examination the patient was found to be in good general condition. The temperature, pulse, and blood-pressure were normal. The enlarged right knee was markedly tender and painful; it was held at fixation of 160 degrees. The urine contained an occasional pus-cell. The hemoglobin was 70 per cent. and the leukocyte count 11,600. The Wassermann reaction on the blood was negative. Destructive arthritis of the right knee with considerable synovial thickening was shown in the roentgenogram.

August 13th the right knee-joint was opened and a sarcoma of the periosteum of the mixed-cell type was discovered. The tumor had originated on the posterior surface of the lower part of the femur and had pushed its way through to the anterior part of the joint. The thigh was amputated, and *x*-ray, radium, and Coley's treatment were given.

When we examined the patient we believed that his condition might be tuberculous. He was warned, however, of the possibility of sarcoma, and his consent was obtained for an amputation if it should be necessary. The points of interest in the history of the case are that eighteen years before the knee had been injured; it had been operated on elsewhere twice. During these years there was occasional stiffness and soreness in the knee. In 1919, following influenza, the knee became so swollen it could not be straightened. Operations had been performed elsewhere and a cartilage removed, with slight improvement. During the last six months the pain had been much more severe and during the last two months the enlargement had been rapid. Whether the old inflammation had anything to do with the cause of the sarcoma is difficult to determine, but a few cases have been observed in the Clinic in which there had been a long history of trouble of the knee-joint and an apparently rapid development of sarcoma. So far as we could judge the sarcoma in this case seemed to arise from the periosteum in the posterior part of the femur just about the epiphyseal line. Primary sarcomas of the synovia are rare, and this case would have been regarded as a primary sarcoma of the synovia if the cross-section of the specimen had not determined accurately its origin.

The prognosis in these cases is poor; not more than 4 per cent.

of the patients live longer than three years. Death is usually directly due to metastasis to the lungs. Treatment with radium and *x*-ray is advised; benefit may be obtained with Coley's serum (Fig. 650).

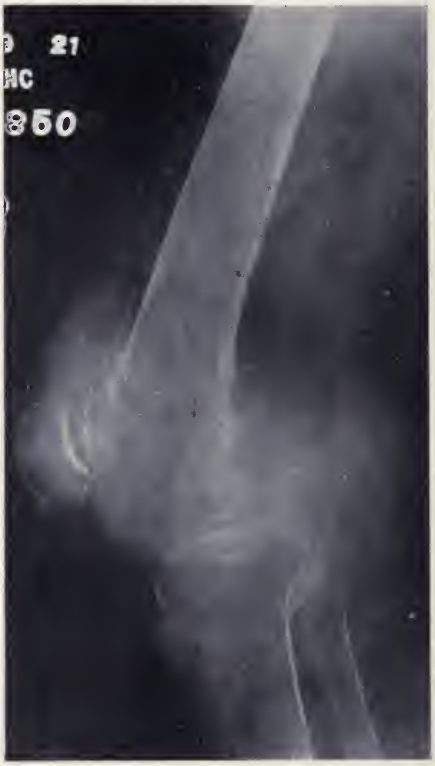

Fig. 650.—(Case A367,850.) Periosteal sarcoma of the femur just about the epiphyseal line. The tumor extended into the knee-joint and even into the suprapatellar pouch, simulating tuberculosis in appearance.

CLINIC OF DR. WALTER E. SISTRUNK

CANCER OF THE BREAST

This patient (Case A367,971), Mrs. J. D., aged forty-five years, first noticed a painless tumor in the right breast two weeks ago. There has been no discharge from the nipple. Examination shows a tumor, 2 cm. in diameter, in the upper, outer quadrant of the breast, and attached to the skin. Enlarged glands cannot be felt in the axilla.

In the greater number of patients a clinical diagnosis of cancer of the breast can be made. The tumors are usually hard, and very early in their course cause an inflammatory reaction which, in turn, causes contraction of the fibrous tissue trabeculæ lying between the growth and the skin, thus giving to the palpating hand a "feel" that the growth is attached to the skin. Such tumors almost invariably prove to be malignant. In cases in which this attachment is not apparent but the tumor is hard, with indefinite edges which seem to extend into the tissue of the breast, the diagnosis is established. Most cancers of the breast enlarge slowly, although the rapidity of growth varies. It is not unusual to see a malignant tumor which has remained practically stationary for a number of months suddenly enlarge, rapidly involve the skin, and ulcerate.

The results obtained from operation depend largely on the extent of the disease at the time of operation. The statistics in the Clinic show that 64 per cent. of the patients operated on before the glands become involved, regardless of the duration of the disease, live from five to eight years after operation. When the glands are involved only 19 per cent. live for this length of time. These statistics are based on consecutive patients traced, and from them it may be assumed that if all patients with cancer of the breast were operated on very early in the course of the disease 75 or 80 per cent. would obtain from five-year to eight-year cures.

Unfortunately, the greater number of patients with cancer of the breast are seen late in the course of the disease. In a group of 218 patients studied recently the glands were found to be involved in 60.5 per cent. Diffuse carcinomas with glandular involvement were found in 16 patients, and extensive ulcerating growths in 20. Improvement in results will undoubtedly be obtained only by operating earlier, since it does not seem likely that a change in the operation as it is now performed will materially affect the end-results.

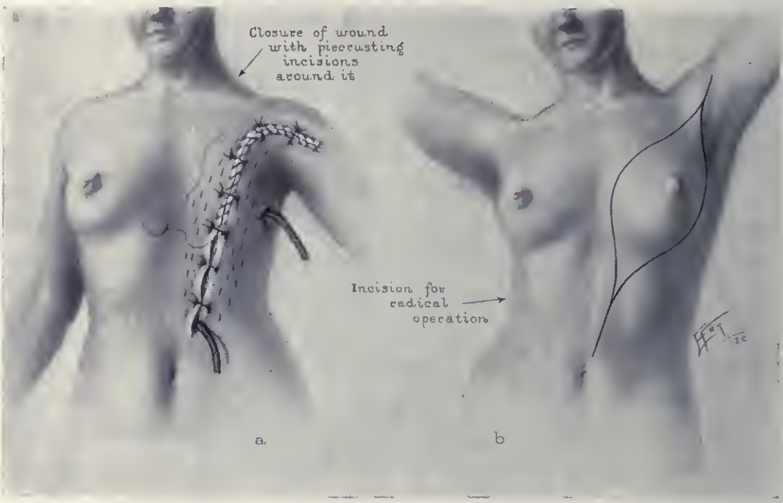
Closure of wound with piecrusting incisions around it
Incision for radical operation
a
b

Fig. 651.—*a*, The wound after the edges of skin have been approximated. *b*, Outline for incision in the radical amputation of the breast.

In performing the radical amputation we remove the skin and subcutaneous fat widely and sacrifice both pectoral muscles. The axillary lymphatics are then dissected, with removal of the glands and fascia from the infraclavicular triangles. A portion of the fascia covering the upper portion of the rectus muscle is also removed. The posterior thoracic and the long subscapular nerves are preserved. A slight modification of the Rodman incision is used, and in practically all instances it is possible to unite the edges of the skin at the close of the operation (Figs. 651, 652). Following such operations the function of the arm

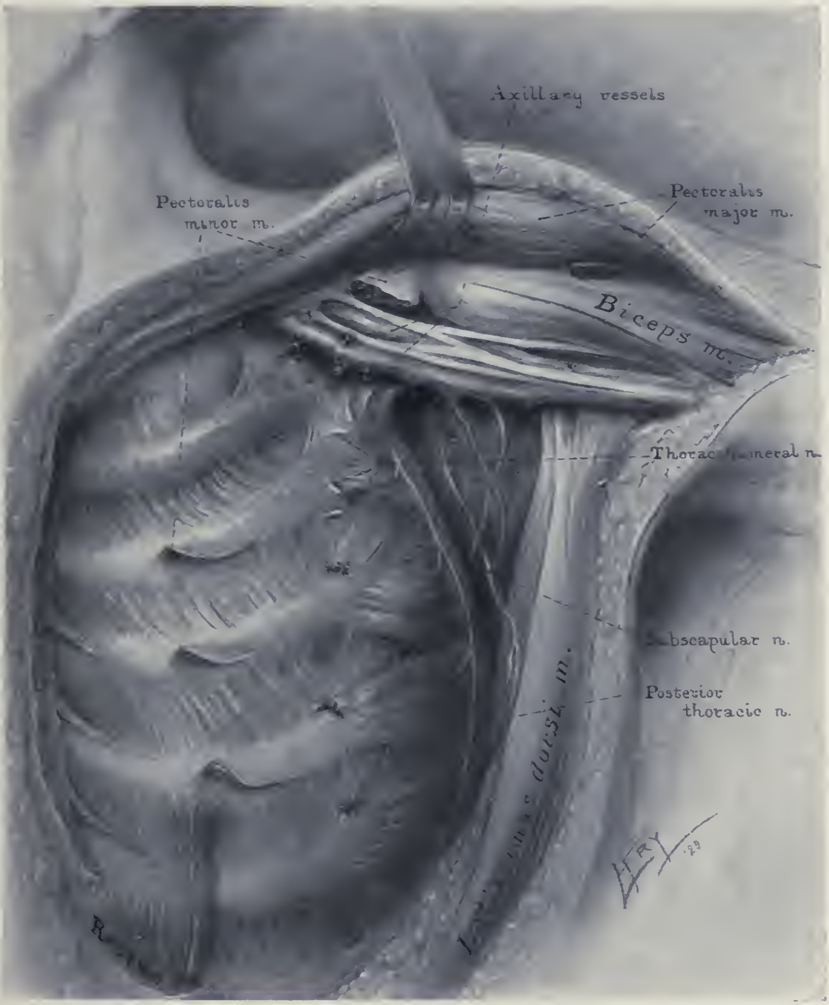

Fig. 652.—Dissection complete and the vessels tied. The posterior thoracic nerve and the long subscapular nerves are left intact.

is almost perfect. Impairment of function is seen only in patients who are timid and fail, on account of pain, systematically to exercise the arm. The work of Handley has tended to show that when the skin becomes involved the malignancy diffuses through the lymphatics of the skin for a considerable distance beyond the growth, and in such cases it is necessary to remove widely the skin surrounding the involved area in order to prevent recurrence.

Recurrences seldom develop in the axilla following operation even in cases in which the axillary glands are involved, and local recurrences occur in only 10.5 per cent. of the cases in which the glands are not involved. It is probable that the majority of recurrences in early cases is owing to carcinomatous tissue, inaccessible to the knife, which was not removed. Possibly some improvement in results may be obtained by intensive *x*-ray or radium treatment before or during the operation.

In the series of 218 patients the cancer occurred most often in the upper half of the breast (46.8 per cent.) and least often in the inner half. The largest number of cures was in cases in which the growth was located in the upper inner quadrant (52.6 per cent.) and the smallest number in cases in which it was located in the lower inner quadrant (25 per cent.). The lymphatic drainage from the lower inner quadrant is probably largely through the vessels accompanying the branches of the internal mammary and intercostal arteries, lymphatics which cannot be removed surgically; this, no doubt, accounts for the marked differences in results (Fig 653).

Certain types of cancer seem to be highly malignant. For example, we have found that cancers occurring in pregnant and lactating women are practically always fatal. The diffuse growths which apparently develop on a pre-existing mastitis and involve the entire breast always produce death. Recurrences in the order of frequency are, in local areas, the chest, the bones (the spine, as a rule), the abdominal cavity, and the brain, respectively. In our patients with local recurrences metastasis was demonstrated at some other point in 60.5 per cent., a complication which should be considered in operating for local recurrence. Two and a half per cent. of the 218 patients died within six months after operation; 21.1 per cent. were dead at the end of the first year; 34.9 per cent. at the end of two years; 42.4 per cent. at the end of three years; 49.1 per cent. at the end of four years, and 55 per cent. at the end of five years. Only 2.3

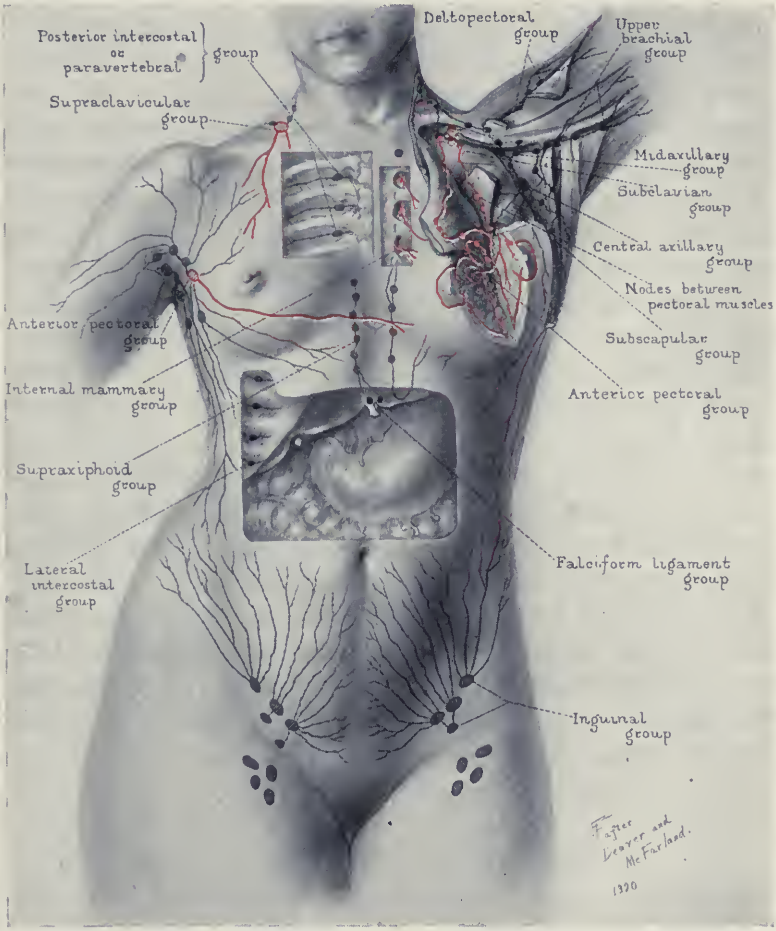

Fig. 653.—The lymphatic drainage of the breast. The red dots represent the terminal lymph-nodes that drain the breast. The black lines and dots represent lymphatic systems which are more or less directly related to the mammary system of lymphatics (after Deaver and MacFarland).

per cent. died after five years. Freedom from recurrence for three years certainly does not constitute a cure. Freedom for five years offers a much better chance for cure; we have seen very few recurrences after eight years, although they have been reported from twelve to thirty years after operation. Nine of the 80 patients (36.7 per cent.) of the group of 218 who are alive from five to eight years after operation are known to have recurrences. Eighty-five (39 per cent.) were alive at the end of five years. These results are almost identical with those reported by Judd and me in 1914 in a group of 510 patients, 39.8 per cent. of whom obtained five-year cures.

Even simple operations offer an excellent chance for cure in early cancer. The histories of 6 patients in whom a simple amputation had been performed for supposed mastitis, later found by the pathologist to be definite cancer, show that 1 patient lived eight years, 2 patients lived seven years, and 1 patient lived six years. One patient died four years after operation, but we were unable to ascertain the cause of death. One patient was alive and without recurrence when last heard from two years after operation. It is our practice in questionable cases to remove the tumor with a good margin of the breast tissue surrounding it, and to have an immediate diagnosis made from a frozen section. So far as we are able to ascertain, when this procedure has been followed by an immediate radical amputation, the prognosis has not been affected.

CYSTS OF THE THYROGLOSSAL TRACT

Mr. A. S. (Case A311,227) has had this tumor in the middle line of the neck since he was twenty-three years of age, nearly thirty years. For two or three years it has been increasing slowly in size, but it has never been painful or tender; it has not been treated. The tumor is soft, fluctuating, and painless, about 4 by 4.5 cm. in diameter. It can be palpated in the anterior middle line of the neck a little below the thyroid cartilage.

Cysts of the thyroglossal tract develop through failure of complete obliteration of the epithelium which is carried down by the descent of the thyroid gland. Very early in fetal life the thyroid gland develops at the base of the tongue and descends in the middle line of the neck to its normal position. Normally, the epithelium lining the tract through which the thyroid descends disappears. If the epithelium fails to disappear, isolated areas of thyroid tissue (aberrant thyroid) or cysts may develop along its course (Figs. 654, 655).

The diagnosis of cyst of the thyroglossal tract is, as a rule, not difficult, and is made by finding a rather firm cystic tumor in the middle line of the neck, usually near the hyoid bone or the thyroid cartilage. Usually the duct, which runs from the cyst to the hyoid bone, may be palpated. In some cases the cyst becomes infected and forms an abscess, which, on rupturing or being opened, leaves a sinus that may persist for a number of years.

The cure of the condition necessitates complete removal of the epithelium-lined tract. Unless the tract is removed completely the condition often recurs. As a rule the cyst and the portion of the tract lying below the hyoid bone may be dissected out without difficulty, but above the hyoid bone the tract is so small and friable that it is broken off easily and consequently is difficult to remove. The highest percentage of cures is obtained through an operation in which a portion of the hyoid bone, the thyroglossal tract, and the tissues surrounding it are removed without an attempt definitely to isolate the duct.

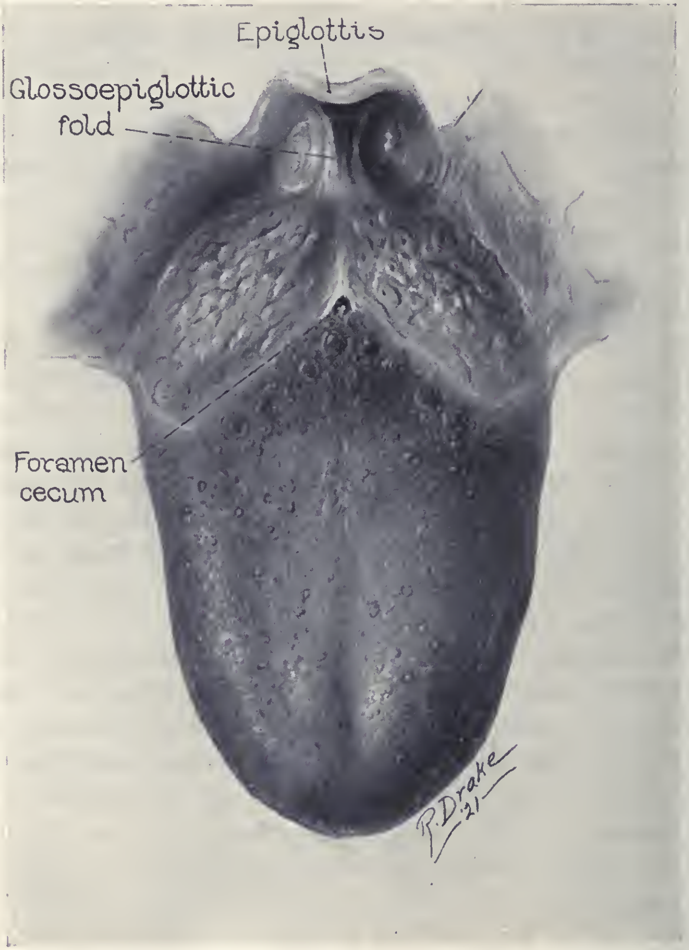

Fig. 654.—Anatomy of the dorsal surface of the tongue and the position of the foramen cecum.

We usually perform the operation through a transverse incision, about 5 cm. long, across the neck at the level of the hyoid bone. The skin and platysma muscles are reflected. The cyst is found lying between the raphé connecting the sternohyoid

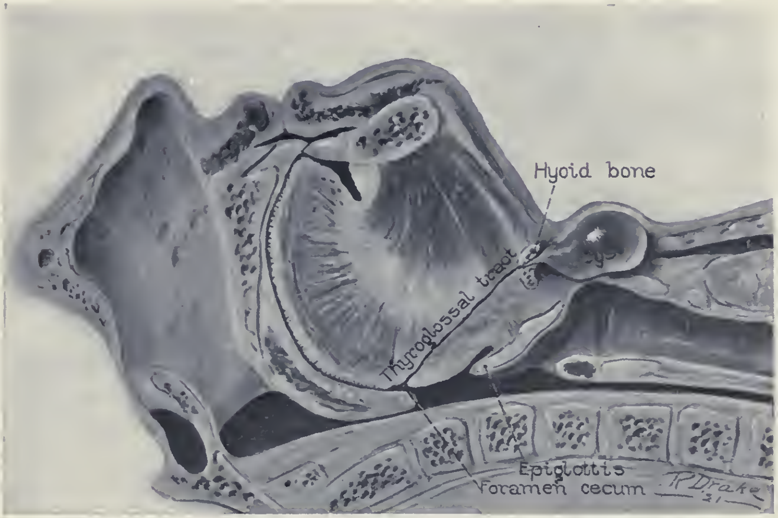

Fig. 655.—The thyroglossal tract with a cyst in the position usual in such cases.

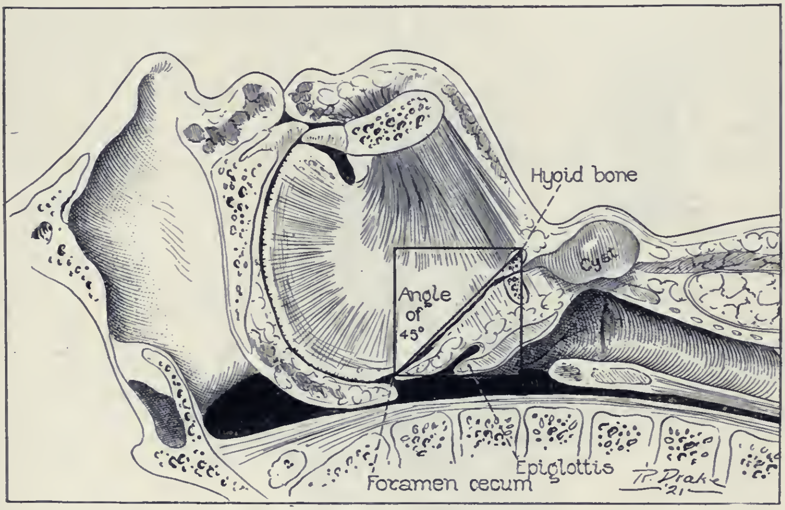

Fig. 656.—The line along which the dissection must be carried in order to remove completely the thyroglossal tract.

muscles. It is dissected free up to the hyoid bone (Fig. 656). At this point the tract usually passes through the hyoid bone,

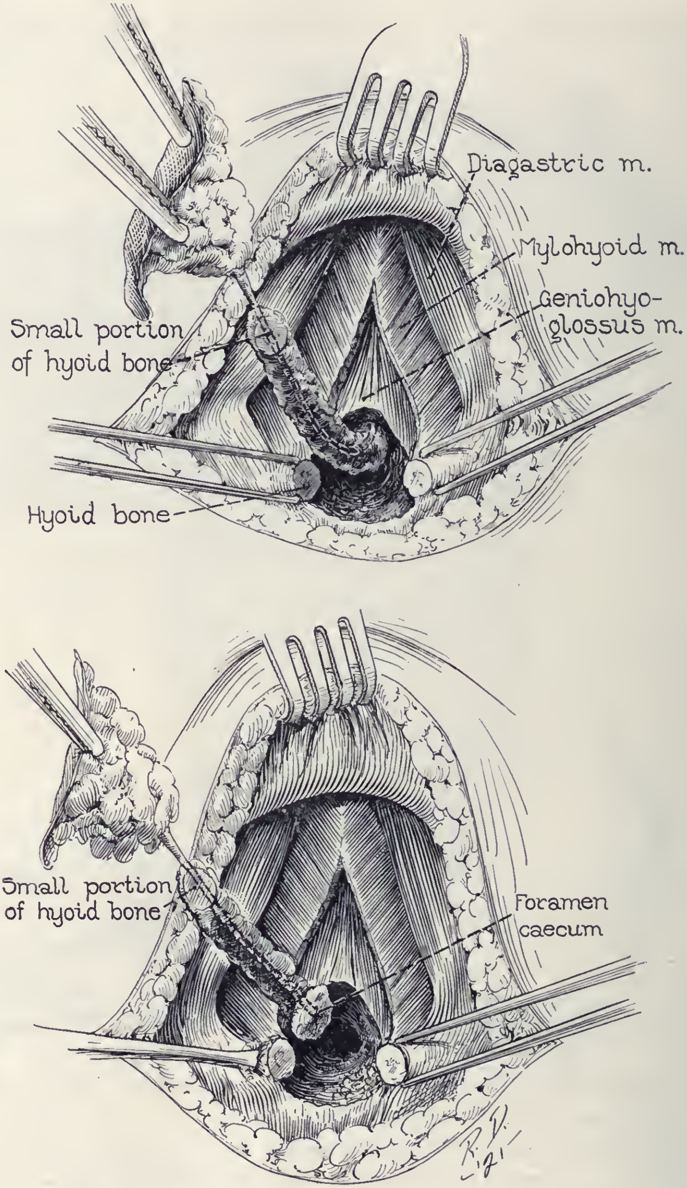

Fig. 657.—Steps of operation. The thyroglossal duct cyst is removed with the portion of the thyroglossal tract lying between the hyoid bone and the foramen cecum.

although it may be found passing either above or below it. The muscles are separated from the center of the hyoid bone, and about 0.3 cm. of the bone is removed; then, without any attempt to isolate the duct, the tissues are cored out from this point directly to the foramen cecum, and the duct with the tissues surrounding it for a distance of about 0.3 cm. on every side is removed (Fig. 657). In doing this it is necessary to keep clearly in mind the direction of the foramen cecum. This corresponds to a line drawn at an angle of 45 degrees, backward and upward, through the intersection of lines drawn horizontal and perpendicular to the superior central portion of the hyoid bone. In the dissection, the duct, a portion of the hyoid bone, a portion of the raphé joining the mylohyoid muscles, a portion of each of the geniohyoglossus muscles, and the foramen cecum are removed. The opening in the mouth is closed and the geniohyoglossus muscles are drawn together with interrupted catgut sutures. The tissues surrounding the cut ends of the hyoid bone are brought together with chromic catgut sutures in such a manner as to approximate the edges of bone. A small rubber tube is introduced down to this point and the skin closed. Since this type of operation has been used in the Clinic all the patients operated on, as far as I have been able to ascertain, have been cured, whereas previously operative procedures often failed to effect a cure.

TUMOR OF THE PAROTID GLAND

Mrs. J. T. (Case A262,680), aged fifty-eight years, came for consultation because of this small tumor a little above the jaw-bone, in front of the ear. As long as she can remember she has had a small nodule in this location. For the last year the tumor has increased in size. The tumor is hard and movable, about 4 by 5 cm. in diameter, and is in front of the ear about 2.5 cm. above the angle of the jaw-bone.

Our statistics show that mixed tumors of the parotid gland occur in one of every 1607 patients examined. Tumors of the salivary glands occur eleven or twelve times as often in the parotid glands as in the submaxillary salivary glands, and are practically never found in the sublingual salivary glands. They are found with about equal frequency on the right and left sides. The tumors are painless, encapsulated, firm, and small, rounded, or irregular shaped. The rapidity of growth varies; in some instances it is very rapid; in others it remains stationary for a number of years. As long as the growth remains encapsulated it is not highly malignant, and if the entire tumor with its capsule is removed cure is effected. If, however, the capsule is ruptured through trauma, or if an incomplete operation is performed, the growth invades the tissues surrounding it and often undergoes more malignant change. In such instances metastasis may occur in the lymphatics draining this region.

Pathologists differ in their opinions with regard to the etiology of these tumors; many believe that the tumors originate from encapsulated fetal rests in the parotid. Pathologically the tumors have been classified as mesotheliomas, carcinomas, and basal-cell epitheliomas. In some instances the tissue on the interior of the capsule is composed largely of epithelial elements; in some tissue resembling cartilage predominates; and in others a large amount of the tissue is fibrous. Often sections from different portions of the same tumor show very different microscopic pictures.

Were it not for the fact that facial paralysis follows the removal of the parotid gland, the entire gland could be removed from patients who come for treatment early in the disease, and practically all the patients would be cured. Such a procedure is usually followed when tumors are found in the submaxillary salivary gland. Many incomplete operations are performed in efforts to avoid the facial nerve, with resulting recurrences, and many tumors grow to a large size because patients, fearing

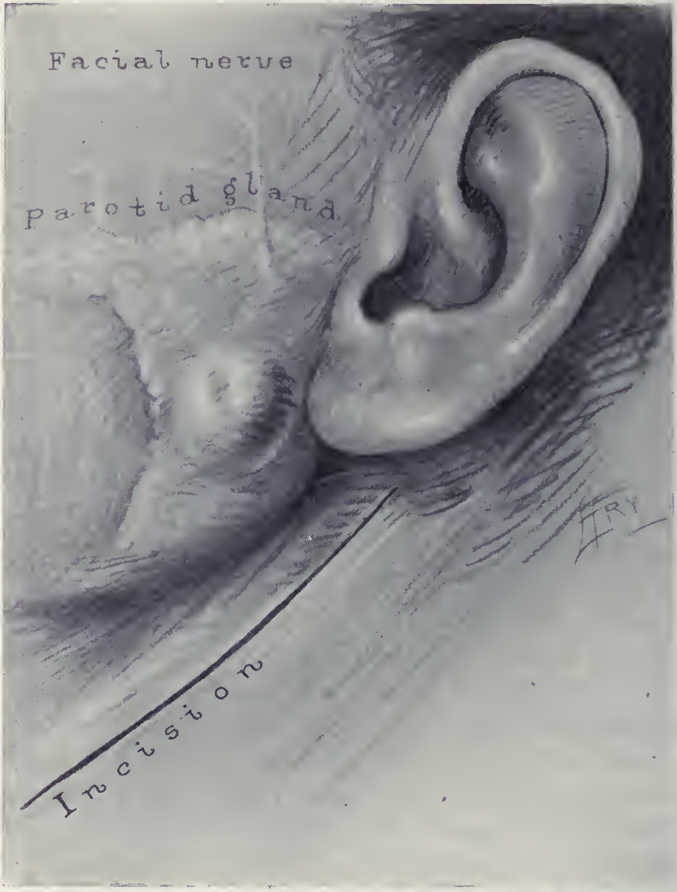

Fig. 658.—Incision along crease in the neck which usually is employed in the removal of parotid tumors.

facial paralysis, refuse to submit to operation. Surgery seems to be about the only means of successfully treating the condition. Thus far we have not had cures following the use of *x*-ray or radium.

In operating, an oblique incision is usually made in the skin along the creases of the neck at a point about 1.8 cm. below the angle of the jaw and extending from the lower portion of the mastoid process for about 7.5 cm. toward the thyroid cartilage (Fig. 658). The skin and subcutaneous fat are reflected upward and the parotid gland exposed. The tumors usually are in the anterior portion of the gland and anterior to the facial nerve, which passes through the posterior portion of the gland.

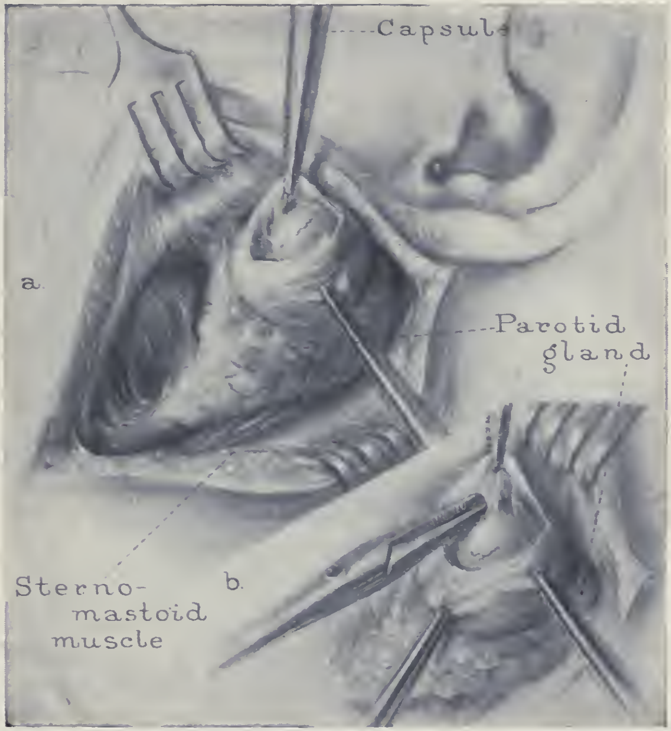

Fig. 659.—*a*, Skin and platysma muscle reflected and the parotid tissue covering the tumor incised in the direction of the fibers of the facial nerve. *b*, Enucleation of tumor by blunt dissection with a pointed hemostat.

A transverse incision is made in the direction of the branches of the facial nerve through the parotid tissue down to the encapsulated tumor, which is enucleated by blunt dissection (Fig. 659). Often the capsule is very thin and ruptures during removal. In this event extreme care should be used to remove the capsule. If it collapses after a portion of its contents has escaped a small piece of gauze may be packed into the cavity in order to distend the sac and define its outline, and thus aid in its removal. After the tumor has been removed the wound is washed with salt solution in order to remove as well as possible all cellular elements which may have escaped from the sac, and swabbed with Harrington's solution (a strong solution of bichlorid of mercury with hydrochloric acid in alcohol), in order to destroy any cells which may be lying free in the wound. The cavity is then packed with a small strip of gauze saturated with Harrington's solution (Fig. 660).

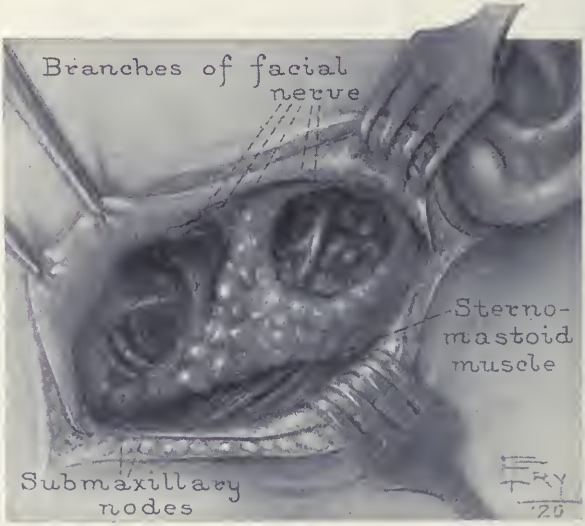

Fig. 660.—Cavity in the parotid gland after removal of the tumor. Facial nerve in the bottom of the cavity.

As a primary operation such a procedure is not difficult, and if the tumor is small a cure can be effected without injury to the nerve (Fig. 661). In patients who have been operated on previously, however, a large amount of fibrous tissue is usually found which adds considerably to the difficulty of complete removal. In such cases and in cases in which the tumor has been allowed to attain considerable size injury to the nerve may be avoided sometimes through the following procedure: The inframandibular branch of the facial nerve is isolated as it runs around the angle of the jaw beneath the platysma muscle at a point about 1.5 cm. below the angle. This nerve is dissected up through the substance of the parotid gland to the division of the facial nerve into the temporal and cervical. The tumor nearly always is found lying anterior to the nerve. If a finger is introduced between the nerve and the portion of the parotid which has been lifted from the nerve (Fig. 662), the surgeon may feel

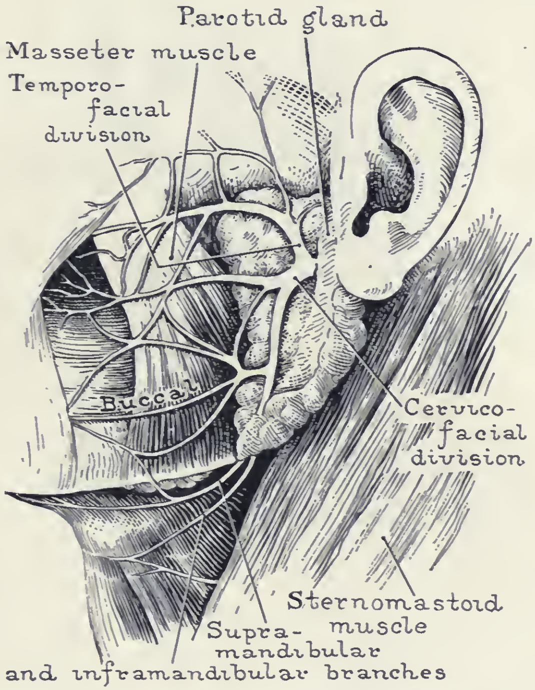

Fig. 661.—Anatomy of facial nerve as it passes through the parotid gland. The anterior portion of the gland has been removed.

confident that the enucleation is being carried on in a plane lying above the nerve, and, although a temporary paralysis may occur from traumatism to the nerve, it usually disappears within a year.

The results following the surgical removal of parotid tumors are, indeed, excellent. Recently I studied the histories of 66 consecutive patients who were traced, on whom primary operations had been performed from one to five years previously, and of 37 patients on whom operation had been performed for recurring tumors. It was found that 93.4 per cent. of the patients who had primary operations were alive, 18.3 per cent. with recurrences, and 6.6 per cent. are dead; 89.2 per cent. of the patients

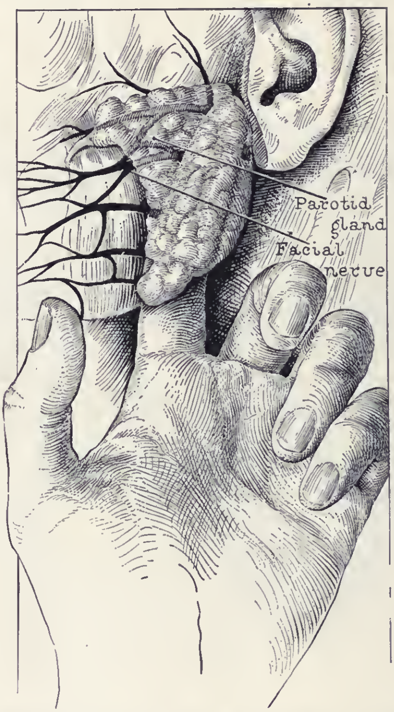

Fig. 662.—Method sometimes used in trying to prevent injury to the facial nerve. The facial nerve has been exposed and separated from the anterior portion of the parotid gland. A finger is kept in front of the nerve while the tumor is being removed.

operated on for recurring growths are alive, 37.8 per cent. with recurrences, and 10.8 per cent. are dead. There were no deaths following operation in this series. The most serious complications following operation are partial or complete facial paralysis and salivary fistulas. Sixteen of the 66 patients on whom primary operations were performed had temporary paralysis for from six weeks to one year. One patient had permanent partial paralysis and one permanent complete paralysis. Sixteen of the 37 patients operated on for recurring growths had temporary paralysis with a return of the function of the nerve after periods varying from six weeks to one year, while 2 of these patients had permanent complete paralysis and 5 permanent partial paralysis. One of the patients who had a primary operation developed a salivary fistula which has persisted for five years and nine months, and one patient operated on for a recurring tumor developed a salivary fistula which has persisted for seven years.

ELEPHANTIASIS

Mr. C. A. J. (Case A308,040), who is fifty years of age, first came to the Clinic in March, 1920. When he was seven or eight years old he first noticed swelling of the left ankle in the evening, which disappeared by morning. The swelling gradually spread upward, until at the age of twelve it involved the leg as high as the knee. At eighteen years he had several attacks of inflammation in the leg, with local swelling and redness of the skin, which were associated with chills and fever, probably eryispelas. Within two years there was a huge enlargement of the leg extending to the groin. Rest in bed, elevation, and catharsis always caused reduction in the size of the limb.

At the time of admission to the Clinic the patient had a tremendous enlargement of the left leg, thigh, and foot, with large localized areas of edema and thickening of the skin (Figs. 663, 664). Measurements of the two lower extremities were:

Thigh at the trochanter	right leg,	20 inches
	left leg,	32 inches
Middle of thigh	right leg,	18 inches
	left leg,	45 inches
Knee	right leg,	16 inches
	left leg,	35½ inches
Middle of leg	right leg,	13½ inches
	left leg,	57 inches
Ankle	right leg,	6 inches
	left leg,	22½ inches

The patient's weight was 340 pounds. The blood was negative for filaria. Rest in bed to reduce the size of the leg was advised, and if the results were favorable, operation. For business reasons the patient went home, promising to return later.

In January of this year the patient was readmitted to the Clinic. He was treated for two months by rest in bed, with elevation and bandaging of the affected limb, and catharsis. During this time he lost 100 pounds in weight and the limb diminished considerably in size. The skin which had been very hard and tense became saggy and pendulous.

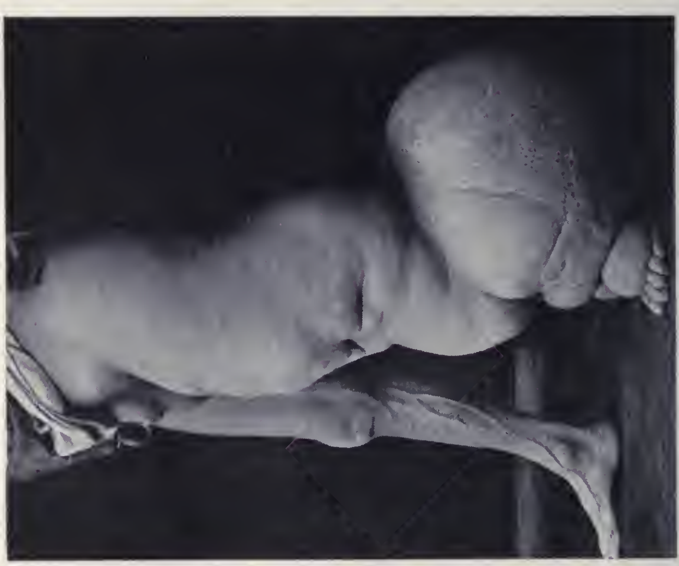

Fig. 663.

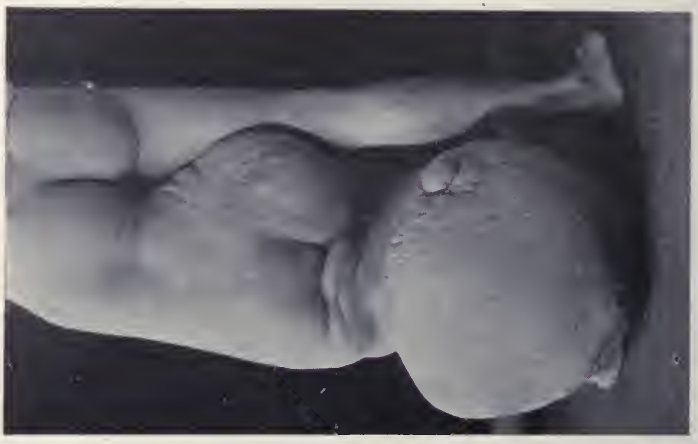

Fig. 664.

Figs. 663, 664.—(Case A308,040.) The patient on admission to the Clinic March 5, 1920.

In March a modified Kondoleon operation was performed. Thirty-four pounds of skin, subcutaneous fat, and aponeurosis were removed in one piece through an incision on the posterior

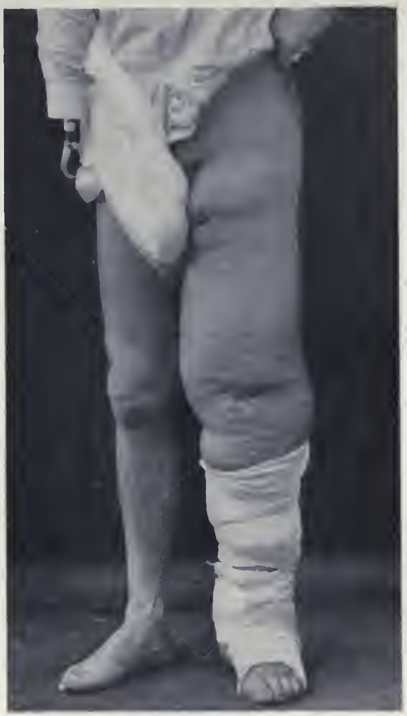

Fig. 665.

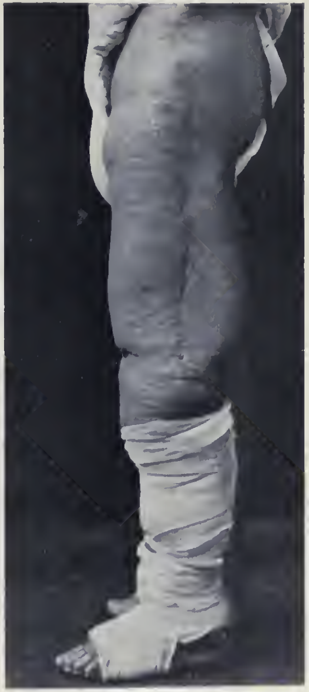

Fig. 666.

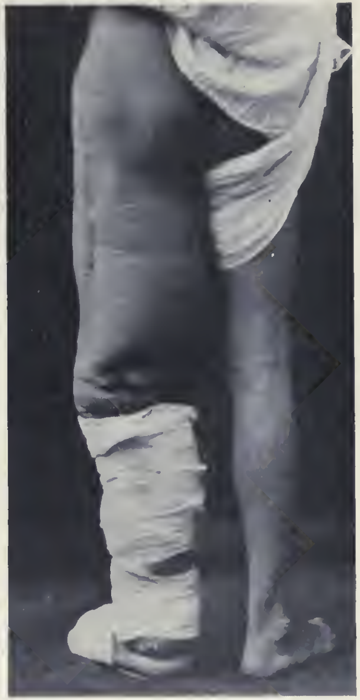

Fig. 667.

Figs. 665–667.—(Case A308,040.) Following the third operation (June 11, 1921) the wound in the thigh, except for about 3 cm., healed by first intention. The areas near the ankle sloughed. July 14th the patient left the hospital with the wound in the thigh healed and the ankle in good condition.

surface of the thigh. Small calcareous nodules, which had probably resulted from venous thrombosis, were scattered throughout the subcutaneous fat. Very large spaces containing straw-colored fluid evidently were completely blocked lymph-spaces.

During the following month in the hospital the patient was treated with lights over the left leg and dry dressings. Twice sloughing tissue was removed. The seropurulent drainage decreased to practically nil.

By the end of April a second operation was possible. At this time the incision was also in the posterior surface of the thigh; a large amount of skin, subcutaneous fat, and aponeurosis was removed. The leg was treated with lights. About May 15th a bandage was applied. The wound healed without drainage or induration. A week ago the patient was dismissed from the hospital with the leg in a bandage.

Today, through a long incision on the outer aspect of the leg from the crest of the ilium to the knee, another large piece of skin, subcutaneous fat, and aponeurosis will be removed (Figs. 665–667). These irregular lumps just above the ankle will be removed through transverse incisions, and the area on the dorsal surface of the foot through a longitudinal incision. Sloughing in these areas may be expected.

The patient will be asked to return for another operation on the inner side of the leg and thigh.

Our ideas with regard to the cause of elephantiasis have changed in recent years; we no longer think of filariasis as the most likely cause. The condition usually develops secondary to an obstruction of the lymphatic or venous circulation of the affected area. Simple lymphedema, if untreated, is liable to be supplemented by elephantiasis; it always precedes elephantiasis. Stagnation of lymph in tissues predisposes them to infection by micro-organisms, and following such infection an obliterative lymphangitis and hypertrophy of the connective-tissue elements of the skin, subcutaneous tissues, and deep aponeurosis may result. Experimental work tends to show that true elephantiasis probably always develops secondary to chronic infection of the tissues by micro-organisms, usually some type of streptococcus. From several of the patients operated on in the Clinic we have obtained green-producing streptococci. The disease, if left untreated, tends to grow progressively worse, and in many instances eventually is characterized by recurring attacks of erysipelas, each of which is followed by an increase in the size of the limb.

The pathologic picture is tremendous thickening of the dermis, of the connective-tissue trabeculæ lying between the dermis and aponeurosis, and of the deep aponeurosis. The epithelial layer of the skin is thinned out through stretching by the edema in the tissues below it, and the elastic fibers largely disappear. The lymph-channels which have not been destroyed by infection are markedly dilated, and extravasated lymph is present in the subcutaneous fat. Areas of round-cell infiltration are found scattered throughout the hypertrophied connective tissue.

In 1912 Kondoleon suggested an operation for elephantiasis which is somewhat similar to operations formerly suggested by Lanz, von Oppel, and Rosanow, in which the disease is treated by removing large amounts of skin, subcutaneous fat, and deep aponeurosis from each side of the affected limb. Such a procedure removes a large amount of obstructed lymphatic tissue which is incapable of carrying on normal function. The aponeurosis covering the muscles seems definitely to separate the superficial and deep lymphatic systems, and when a large amount of this tissue is removed and the skin allowed to drop down on and become attached to the muscles, new blood-vessels and lymphatics form which connect the deep and superficial lymphatic systems. The disease, even in extreme cases, involves only the tissues lying above the deep aponeurosis, and when the deep and superficial circulations are connected in this manner the deep lymphatics evidently help to drain the obstructed superficial system.

In mild cases the operation can usually be performed without preoperative preparation, but in patients with marked enlargement, and especially in patients with marked deformity, the best results follow prolonged rest in bed, with elevation and bandaging of the affected limb. The operation is extensive and is best performed in stages; in some instances three or four operations are necessary to obtain good results. Considerable time may be required for new lymphatics to form, and during this period it is necessary that the limb be bandaged firmly in order to prevent edema. Usually we have found it comparatively easy to control the edema following an operation in patients in whom this was impossible before operation. It seems probable that the prevention of lymph stasis after operation helps to rid the tissues of the streptococcic infection. It is best for patients distinctly to understand before the operation is attempted that it is to control a disease which tends to grow worse progressively unless operation is performed, and that it is impossible to expect the operation to restore the limb to normal; also, that it will be necessary to bandage the limb for an indefinite period following operation.

The Kondoleon operation is now performed as follows: A long modified elliptic incision, which includes the skin to be sacrificed, is made on one side of the affected limb. On the outer aspect of one of the lower extremities this incision extends from the crest of the ilium to a point a little below the external malleolus of the fibula. Then, in order to facilitate a wide removal of the subcutaneous fat, the skin is reflected on each side of the incision for a distance of about 4 cm. The skin is then retracted and underneath each of the edges of reflected skin a long incision is made through the edematous subcutaneous fat down to and including the aponeurosis. These incisions are made almost parallel with the original skin incision. Included between them is a quadrilateral piece of edematous fat and aponeurosis. The two incisions through the aponeurosis are connected at their upper ends by a transverse incision. The tissues to be removed are then free except for the attachment of the aponeurosis to the underlying muscles. By tracting these tissues it is easy to dissect the aponeurosis from the muscles throughout the length of the entire limb and to remove in one long piece the skin, edematous fat, and aponeurosis. The skin with a small amount of subcutaneous fat underneath it is allowed to drop down upon the muscles and the wound is closed with interrupted silkworm-gut sutures, without drainage. It is usually necessary to perform a similar operation on the opposite side of the limb.

On account of the shock which may accompany an operation of this type the patient is given a hypodermic injection of $\frac{1}{6}$ grain morphin one-half hour before the operation is begun. Only one side is operated on at a time. The patient is also treated as though he were suffering from shock for eight or ten hours following the operation. He is usually kept in bed for ten days after the operation, and at least two weeks are allowed to elapse before the second operation is performed.

The results following the Kondoleon operation have been, as a whole, very satisfactory. The limb is usually reduced nearly to normal size, and, if proper co-operation on the part of the patient is secured and bandages properly used, the limb will remain almost normal in size.

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CONTENTS

Clinic of Dr. Howard Lilienthal, *Mt. Sinai and Flower Hospitals* PAGE

Extirpation of a Dermoid Cyst of the Mediastinum 1531
Suppurative Bronchiectasis: Single-stage Lobectomy 1541
Chronic Left Empyema with Thoracic Fistula. Major Thoracoplasty and Lung Mobilization 1551
Multiple Resection of Ribs with Collapse of Chest for Pulmonary Tuberculosis 1557

Clinic of Dr. Richard Lewisohn, *Mt. Sinai Hospital*

Penetrating Ulcers of the Lesser Curvature of the Stomach 1563

Clinic of Dr. John J. Moorhead, *from Division of Traumatic Surgery, Post-Graduate Hospital*

"Traumatic"(?) Inguinal Hernia 1573
Traumatic Spondylitis (Kummel's Disease) 1581
Multiple Fractures of the Left Upper Extremities and Shoulder Girdle 1587
Revision of Laminectomy for Fractured Spine 1593
Knee-joint Injuries 1597

Clinic of Dr. William A. Downes, *St. Luke's Hospital*

Jejunostomy: Its Value in the Treatment of Certain Ulcers of the Stomach and as a Palliative Measure in Inoperable Carcinoma of the Stomach 1619

Clinic of Dr. R. W. Bolling, *St. Luke's Hospital*

Fibrocystic Lesion of Upper Portion of Shaft of Femur 1633

Clinic of Dr. Herbert Willy Meyer, *from the Surgical Service of the New York Skin and Cancer Hospital, Second Division. Service of Dr. George H. Semken*

I. Case of Epithelioma of the Outer Canthus of the Eye. II. Case for Thiersch Skin-grafting 1643

Clinic of Dr. Seward Erdman, *New York Hospital*

High Enterostomy for Relief of Ileus Complicating Appendicitis 1663
Varix in Scarpa's Triangle Simulating Femoral Hernia 1673

Clinic of Dr. Harold Neuhof, *Bellevue, Mt. Sinai, and Montefiore Hospitals*

Intradural Encapsulated Metastatic Adenocarcinoma Attached to Cervical Cord 1679
Endothelioma of Conus and Cauda Equina. Difficulties in Diagnosis. Laminectomy and Removal of Tumor. Rapid Improvement with Return of Reflexes 1687
Giant Endothelioma of Medulla. Suboccipital Craniotomy and Removal of Arches of Atlas and Axis Under Local Anesthesia 1693
Large Cervical Cord Tumor with Slight Sensory Manifestations. Laminectomy and Radical Excision of Tumor. "Cure" not Complete Two Years after Operation 1699
Small Extramedullary Tumor at First Dorsal Segment. Vague Localizing Signs. Advanced Paraplegia. Previous Operation at Another Level. Laminectomy and Removal of Tumor. Course Uninfluenced by Operation 1705

Clinic of Dr. Abraham O. Wilensky, *Mt. Sinai Hospital*

The Neurologic Manifestations of Fracture of the Skull (Craniocerebral Injuries) 1709

Clinic of Dr. Morris H. Kahn, *Beth Israel Hospital*

Cancer of the Lower End of the Esophagus 1725

Clinic of Dr. Frederic W. Bancroft, *Second Surgical Division, New York Hospital*

Old Posterior Dislocation of Shoulder; Closed Reduction Under Anesthesia; Redislocation, Followed by Open Operation 1739
Giant-cell Sarcoma, Lower End of the Radius 1747
Two Cases of Acute Hematogenous Osteomyelitis of The Femur 1757
Two Cases of Localized Bone Abscess (Brodie's Abscess), One Case of Osteitis Fibrosa Cystica, and One Case of Chronic Traumatic Osteomyelitis 1773

Clinic of Dr. Walton Martin, *St. Luke's Hospital*

Osteosarcoma of the Clavicle and Retroperitoneal Sarcoma 1789

Index to Volume 1 1805

THE SURGICAL CLINICS
OF
NORTH AMERICA

Volume 1 Number 6

CLINIC OF DR. HOWARD LILIENTHAL

MT. SINAI AND FLOWER HOSPITALS

EXTIRPATION OF A DERMOID CYST OF THE MEDIASTINUM

TODAY I hope to perform the final step in a series of operations upon an extremely unusual case.

When this young woman was first seen by me in the spring of 1919 she was in the Tuberculosis Department of Bellevue Hospital. She was twenty-eight years old. I saw her as consultant at the request of Dr. James A. Miller and Dr. Henry E. Hale. She stated that she had been healthy until about a year before, when, following an influenza, there was cough and slight expectoration of dark brown mucoid substance. The *x*-ray examination at Bellevue Hospital resulted in the diagnosis of probable pulsating encysted left empyema on the mediastinal side, and it was with this diagnosis that I was asked to see her. Exploratory puncture had been made and a little mucoid fluid containing dark minute masses of pigment was withdrawn, but with little effect on the patient's condition. She left the Tuberculosis Department because there was no evidence that she was suffering from this disease, and entered Mt. Sinai Hospital on October 28, 1919. Her general appearance was that of a delicate girl. There was slight cough; the temperature was 100° F.; the pulse 96, and respirations 24. The physical examination showed dulness from the central line to the left anterior axillary line, and at the fifth rib dulness continuous with that of the heart. Over this region breathing and voice sounds were absent. There was no fremitus and nothing else remarkable was found in the chest.

The urine showed no disease. The *x*-ray demonstrated a semicircular shadow in the middle two-thirds of the chest extending outward from the mediastinum almost to the axillary line (Fig. 669). There was no pulsation on fluoroscopy, although pulsation had been clearly seen at Bellevue Hospital a few weeks before. The left diaphragm was adherent at one point; with the patient lying on her right side the mass fell away from the chest wall, disclosing a slightly hazy area between it and the ribs as if from attenuated adhesions. The outline of the shadow was sharp and there was no area of infiltration in the surrounding lung. The heart was pushed over 1 inch into the right chest.

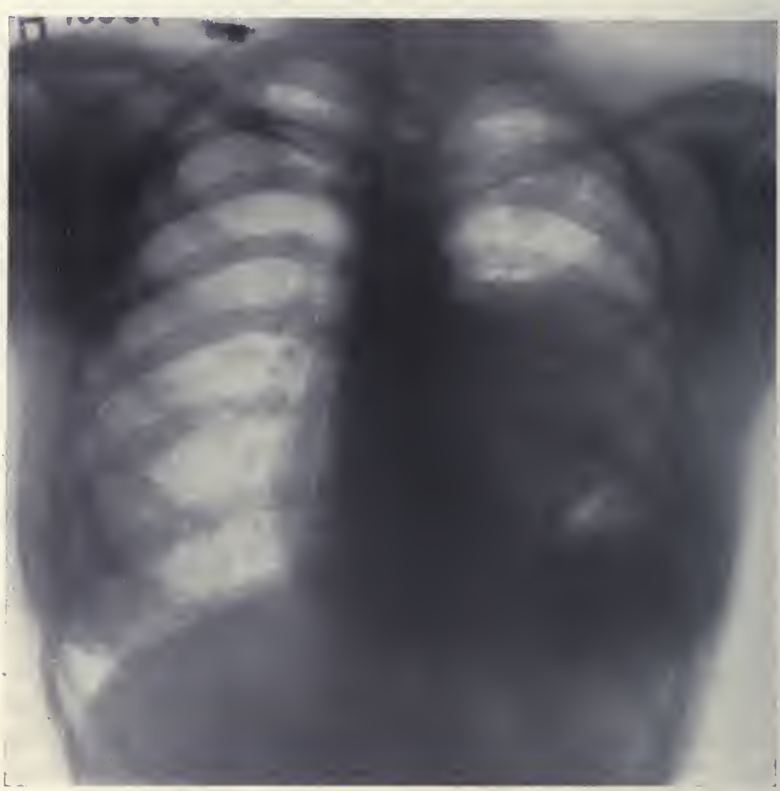

Fig. 668.—Dermoid cyst of mediastinum. Note large semicircular shadow, its base toward the mediastinum.

All sorts of diagnoses had been made, pulsating sacculated empyema and aneurysm of the aorta being the favorites. Dr. Harry Wessler, at Mt. Sinai Hospital, suggested that the tumor was probably a dermoid and that it arose from the mediastinum. For more than nineteen years we had waited in this hospital for our second case of dermoid cyst of the mediastinum, the first one having been operated upon by Dr. A. G. Gerster, the almost moribund patient dying soon afterward. The cyst had become infected and had perforated the chest wall and the operation was a marsupialization for drainage. Our patient of

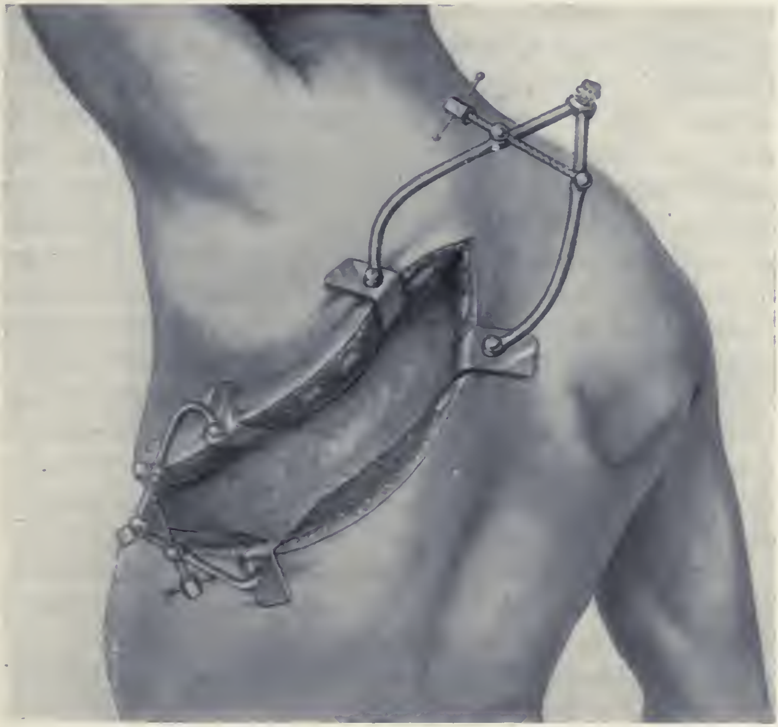

Fig. 669.—Showing Lilienthal's rib-spreader in use. Only one of these instruments is usually necessary. In the case of Miss D. C., where no rib was cut, only one was used. In that of C. McK., however, two spreaders had to be put in. (The instruments are shown too small in the drawing.)

today was more promising, with no sign of infection and with youth and good general condition in her favor.

Bronchoscopy was performed by Dr. Yankauer, who stated that the lumen of the left main bronchus was distorted from pressure by an extrabronchial mass, the pressure appearing to come from the front and outer side. No evidence of lung abscess was seen.

On November 6, 1919 I operated, Dr. William Branower administering gas, oxygen, and ether by the intrapharyngeal method, and Dr. Harold Neuhof assisting. An incision was made from near the costal angle in the seventh interspace forward and downward to the costal cartilages and the rib-spreader was put in place (Fig. 669). No rib was cut. The spreader gave a perfect exposure and, at first, with the lung expanded by the intrapharyngeal differential pressure, little was seen of the mass, most of which was covered by lung. Separating the lobes, however, a tumor the size of a baseball, bluish, translucent, and evidently cystic, was seen occupying the location described in the *x*-ray report. It had extended into the upper lobe of the lung until it appeared anteriorly where the lung gradually thinned out, so that the mass itself was visible for the space of about the size of a silver dollar.

After aspirating about an ounce of thin mucoid substance containing brown grains an unsuccessful attempt was made to enucleate the tumor, and during the attempt the thin sac was ruptured. Immediate microscopic examination of the fluid showed a few white cells. The cyst also contained considerable brown, sebum-like substance in flakes, and at the posterior part of the sac there projected into its cavity two polypoid masses each about the size of an adult thumb. One of these was cut away as a specimen, and it clearly consisted of skin covered with short hair. There was no bubbling or other evidence of connection with the respiratory tract. The cyst apparently sprang from the mediastinum. It was semiglobular in shape, the base occupying an area upon the pericardium so densely adherent to this delicate membrane that all idea of dissecting it away was abandoned. Marsupialization was now decided upon as a temporary measure, and by suturing I reduced the size of the opening into the cyst and fastened it to the chest wall. A small resection of the ninth rib posteriorly was made for tube drainage of the pleural cavity, another tube was placed in the hollow of the cyst, and the main intercostal thoracotomy wound was closed with three chromicized catgut pericostal sutures and the usual closure in layers. The ribs easily came together.

The operation had been very well borne, the patient's color remaining excellent throughout. After the closure of the chest the lungs were inflated through the anesthesia tube, and the tightly fitting drainage-tube was clamped so as to maintain normal intrathoracic negative pressure. When the patient was in bed the lower tube was connected with a longer one, the end of which lay under lysol solution in a vessel under the bed. Scarcely any reaction followed this operation. A small quantity of bloody serum was discharged from the pleural cavity through the suction-tube and about 2½ ounces of bloody fluid were aspirated by syringe through the tube lying in the cyst itself.

Five days after the operation the patient was out of bed, and on November 23d, twenty-six days after operation, she was sent home with the opening into the cyst still present. The main wound had healed primarily.

I hoped that there would form a narrow channel lined completely with epithelium from the skin of the chest to the lining of the dermoid, and that the secretion would become insignificant and sebaceous in character, so that the danger of a radical operation such as we are about to do today for extirpating the sac might be avoided. However, it became necessary to have her readmitted in order to dilate the rapidly contracting fistula, and on December 20, 1920, in local anesthesia with novocain and adrenalin, an incision was made along the front part of the old scar and the rib above the sinus was subperiosteally resected for about 1½ inches. The wall of the tract was incised toward the left side and rapidly dilated with the finger. The cavity was then cureted and packed with gauze. Two days later the gauze was removed and one large and one small drainage-tube were inserted merely to keep the orifice wide. The discharge, however, continued and necessitated frequent dressings, so it was seen that something else would have to be done.

The patient, Miss C., was presented at a meeting of the New York Society for Thoracic Surgery, and suggestions were requested as to the subsequent conduct of the case. Dr. Willy Meyer believed that before risking an operation for the extirpation of the tract an attempt should be made to destroy the lining by chemical means. This attempt was made, using a fluid containing 10 parts of zinc chlorid, 10 parts of sulphate of copper, and 80 of water. Applications were made a number of times, but always there was considerable febrile reaction and much pain. Apparently the cutaneous lining of the cyst contained sensitive nerve-endings. Various antiseptics were then employed and gradually the opening recontracted, but the discharge was purulent and infected with Bacillus pyocyaneus and the daily dressings were terribly annoying. Miss C., who always was a good sport, expressed her willingness to take any chances that I was willing to take if only she might be finally rid of this troublesome condition so long and patiently borne, although she knew quite well that the actual danger to life from the presence of the cyst with its almost certain enlargement had been done away with in the first operation. So here we have her once more on the operating table, with Dr. Harry Goldman administering the ether. Remember, it is a year and four months since my first operation.

First we will irrigate the cavity with sterile water; then we will wash it out through a catheter, using strong alcohol, so as to dry the lining of the cyst. The probe, as you see, shows that the sinus runs upward and inward toward the median line to what seems to be a truly dangerous depth. We now fill the cavity with a strong aqueous solution of methylene-blue in order more sharply to differentiate the appearance of the cyst lining from the surrounding tissue. With the scalpel I will incise the skin parallel with the line of the sinus upward and curving around the outer border of the left mamma which must be dissected up and retracted so as to expose clearly the bony chest wall (Fig. 670). I now take the large Liston bone forceps and remove a section of the ninth rib, then of the eighth, and then of the seventh, which should give us plenty of room. I greatly fear wounding the pleura or even perhaps the pericardium, but these dangers are unavoidable. We now have the pleura before us, and it is clear that in spite of all our precautions we have entered its cavity at one minute point. As you see, however, it can be nicely closed by two catgut sutures so that all hissing and bubbling have disappeared. We shall now open the sinus from below upward and the walls of our wound can be retracted. The lining membrane of the cyst is brought clearly into view; you see that, after all, it has not taken the blue dye, but has retained the color of skin. This is probably because of the presence of an abnormal coating of sebaceous material so common in the skin of dermoid tumors. However, this skin is so white and its structure so characteristic that we

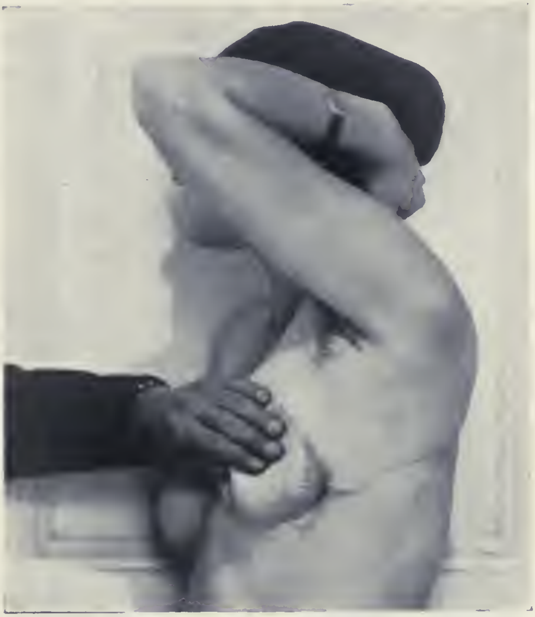

Fig. 670.—Miss D. C. Final photograph showing wound soundly healed, anterior and lateral portion. The perimammary part is the scar resulting from the wound made at the time of the operative clinic here reported.

shall have no difficulty in recognizing it in all the nooks and corners of this wound. With mouse-tooth forceps and scissors we will now dissect away every particle of skin which we can see. The job is far from being an easy one and becomes a bit tedious. I see that in addition to having wounded the pleura we now have a slit about $\frac{1}{4}$ inch long in the pericardium, so that the heart itself can be seen by holding the lips of this slit apart with forceps. But, fortunately, here again we are able to correct the defect with a couple of fine chromicized catgut stitches. I do not believe that there will be infection in the pericardium from this opening because we have so carefully washed out and disinfected with alcohol the cyst cavity. In order to be sure, however, we will swab out the entire wound with tincture of iodin and pack it with iodoformized gauze. The cutaneous wound seems larger than it need be, so we will close the upper portion with a few metal clips.

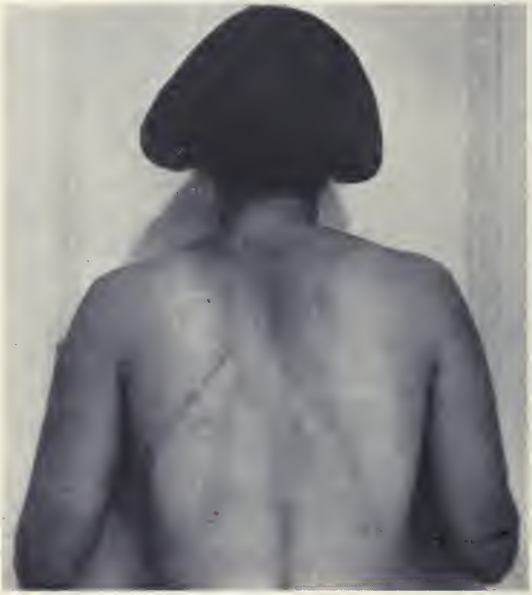

Fig. 671.—Showing posterior portion of scar in the case of Miss D. C.

The patient has stood the operation extremely well. The breathing is quiet and the pulse steady. A dry dressing and bandage will now be applied and the patient will be sent back to bed.

Postoperative Notes.—A reaction with fever up to 102° F. followed this procedure. In a few days the Carrel-Dakin method of wound disinfection was instituted, and then there was rapid progress, so that the patient was discharged with a narrow, slightly discharging sinus about April 5, 1921. Soon after this the sinus closed.

She was seen today (September 21, 1921). She had had a good summer and had gained 30 pounds in weight, probably because of the mental relief. Figures 670 and 671 show the condition of the scars today.

SUPPURATIVE BRONCHIECTASIS: SINGLE-STAGE LOBECTOMY

The case before us this morning is fortunately an unusual one, and yet not so rare as would be apparent from the literature of pulmonary suppurations. I feel convinced that suppurative bronchiectasis is frequently mistaken for other diseases, the commonest of which is tuberculosis. Even this patient, Mrs. A. M., twenty-six years old, a Spanish native of one of the islands of the West Indies, has been treated for tuberculosis, and was kindly referred to me by Dr. Bertram Waters, of the Loomis Sanatorium, where the proper diagnosis was made.

I fear it would bore you to go into the details of the pathology of cases requiring a resection of the lung for suppuration. Roughly speaking, however, they may be divided into two classes: first, the true chronic suppurative bronchiectases which have usually existed for many months, and often years, before the patients are willing to take the desperate chance of this kind of surgery, and, second, the bronchial and peribronchial suppurations in which true abscesses, often multiple, are present. Perhaps the commonest cause of chronic lung suppuration confined to a single lobe or a part of a lobe is the aspiration of a foreign body, although, of course, a breaking-down pneumonia may terminate in a condition of this kind. No absolutely sharp line can be drawn between the multiple lung abscesses and the suppurative bronchiectases, although each individual case will show conditions which classify it as either multiple abscess or bronchiectasis. Following tonsillectomy performed in general anesthesia suppuration in a single lobe is commoner than most throat specialists are willing to admit. To be sure, some of these patients, especially children, get well without operation, and their cases are put down as "postoperative pneumonias," but too frequently the disease becomes chronic and incurable by any means except surgery. It is supposed that during the anesthesia a bit of septic blood-clot or infected tissue from the throat is sucked into the respiratory tubes and forms the starting-point of infection. Unless the case is absolutely clear (and most of them are not) I think that an examination by the bronchoscope should be made. This will check up the appearances shown by the *x*-ray, and the two together form a valuable method for accurately localizing the lesion.

Dr. Sidney Yankauer performed the bronchoscopy here, and he stated that the trouble was unquestionably confined to the left lower lobe. An artificial pneumothorax had been induced in the sanatorium, and before the bronchoscopy it was necessary to withdraw the gas with an aspirating needle. Artificial pneumothorax has been employed many times for the relief or cure of pulmonary suppuration, and occasionally it is followed by great benefit, but usually the diseased part of the lung is so much less compressible than the healthy part that the gas merely prevents the functioning of the normal parts, making little if any compression upon the diseased portions.

This patient's general condition appears to be excellent. Her nutrition is good; her bowels have moved regularly; her tongue is clean. Her disease began following an influenza in December, 1918. Then came the characteristic signs and symptoms of a chronic pulmonary suppuration with the daily discharge of large amounts of foul, purulent matter occasionally streaked with blood. Tubercle bacilli were absent from the sputum.

It is my intention now to open the chest by a long intercostal incision, and I shall probably content myself in this stage with merely loosening the adhesions around the diseased lobe and trying to cause adhesions to form around the upper lobe, so that in the second stage of the operation a week from now the upper lobe will not collapse while we are operating upon the lower, but will remain fixed to the chest wall. We shall then not even require the intrapharyngeal differential pressure which you see being used today by our anesthetist, Dr. Branower. The adhesions are made to take place by rubbing the visceral and parietal pleura with gauze and by laying in a single layer of iodoformized gauze between the lung and chest wall, removing this gauze in forty-eight hours as suggested by Dr. Samuel Robinson of Santa Barbara. Quick adhesion follows.

The patient is now being placed in the proper position for this operation. She lies upon her right side, slightly upon her face, the legs and thighs flexed, and the posture is maintained by bandages and sand-pillows (Figs. 672, 673). Now the bridge

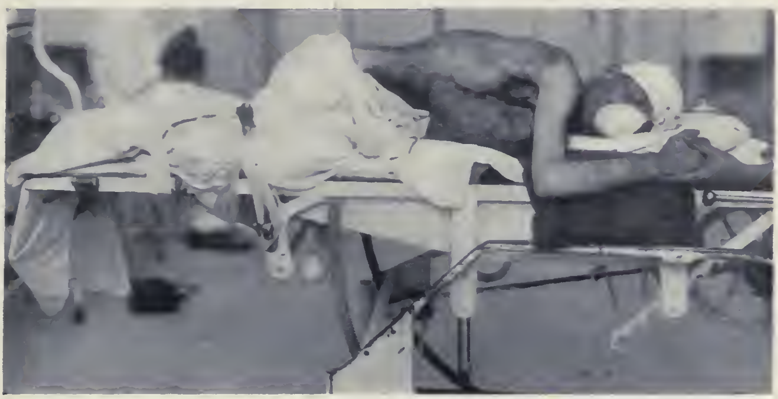

Fig. 672.—Anterior view illustrating position of patient prepared for operation upon the right lung. (This is not a picture of the case here reported.) The bridge of the table is elevated so as to cause scoliosis and a heavy sand cushion keeps the patient from rolling upon the abdomen.

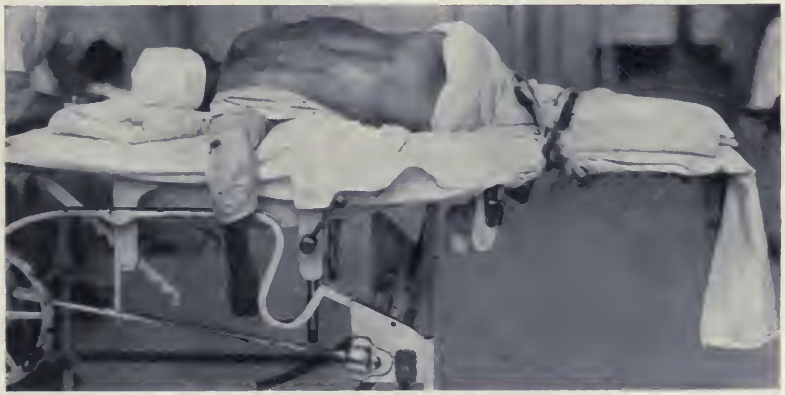

Fig. 673.—Posterior view of same as Fig. 672. The arm does not necessarily hang beside the table. Its position should be changed from time to time.

of the table is elevated so as to cause a scoliosis toward the left, widening the intercostal spaces. The patient has been anesthetized with ether, but soon this will be replaced by nitrous oxid and oxygen, only a little ether being occasionally employed to deepen the narcosis and to secure better relaxation. The entire left half of the chest is now brown with iodin and the drapings are in place.

I make the skin incision, a long one, in the seventh interspace from behind the angle of the ribs almost to the costal cartilages, and now I continue the posterior part of the incision upward behind the scapula and parallel with its border. The muscles are quickly divided, the vessels being caught whenever possible by forceps before they are cut. At last we are down to the ribs and intercostal tissue, and the first portion of the incision is carefully deepened, holding the knife close to the upper border of the eighth rib so as to avoid the intercostal artery. I do not anticipate the presence of adhesions in the upper part of the chest because the *x*-ray has shown that this part of the lung easily collapses. The warning that we are about to enter the pleura is passed to Dr. Branower so that he may begin differential pressure. Now we carefully incise the pleura and, as you see, there is a total absence of the in-and-out rush of air which almost invariably occurs in the absence of positive pressure. The patient breathes quietly; the lung remains gently distended and follows the motions of the chest wall. I now rapidly enlarge the incision into the chest as far back as the angle of the ribs and quickly resect with my large bone forceps of the Liston type about 7 inches of the eighth rib, together with its enveloping periosteum. Through the vertical posterior part of the wound narrow sections of the sixth and seventh ribs are rapidly removed with the forceps. There is so much room that it is simple to catch such vessels as bleed, but you are probably surprised to note that there is scarcely any bleeding from the intercostals. The reason is that the forceps is used with the blades at right angles to the plane of the rib, so that the rib is cut by the blade of the forceps impinging upon the upper and lower margins of the bone instead of in the usual way (Fig. 674). Also, I cut the bone slowly, and this crushes the intercostal structures instead of cutting them, and the artery seldom bleeds. We will now put in the rib retractor and spread the wound widely, which gives us an excellent view of the entire left thorax. It is at once evident that the lower lobe is seriously diseased. Its color is dark and it moves but little on respiration. On palpation I find that it feels quite solid, and even the edge of the upper lobe shows a few small discolored patches suggesting that here also there are possibly small areas of consolidation. To my surprise I find no important adhesions of the lung to the chest wall. You see this filmy membrane connecting the lower lobe with the great vessels posteriorly? It looks as if it were congenital and not due to infection. It appears to me that we have here conditions which make it most tempting to complete the operation in one stage. Indeed, I am afraid that by dividing the operation into two stages we shall only add to the difficulties on account of new adhesions where we do not want them. So we will get on with the work and finish the extirpation at once. The patient thus far has lost hardly any blood; her color is good. Dr. Branower tells us that the pulse and respiration are satisfactory. Between ligatures of catgut I now divide the filmy adhesion which I have just demonstrated, and you see I have the lower lobe in my hand with my fingers surrounding its pedicle which is composed of

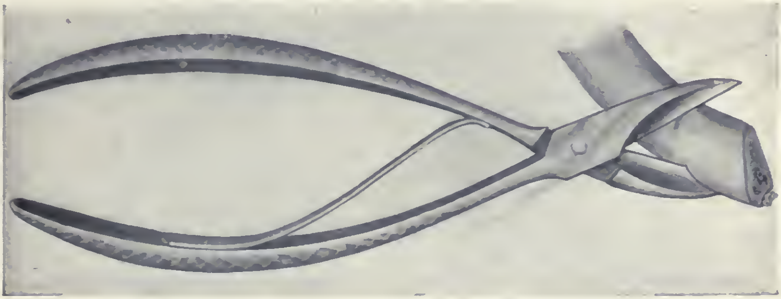

Fig. 674.—Method of cutting rib with periosteum so as to prevent bleeding from intercostal vessels. Also, it is easier this way.

the vessels, nerves, and bronchi which supply the lower lobe all matted together by chronic inflammatory, indurated tissue. I will now pass ligatures of strong silk through this pedicle with the aid of a stout hemostatic needle, and I cut that part of the pedicle which has been constricted by the ligature, leaving a stump about an inch long. I now pass another ligature through another section of the pedicle and divide this as I did the first one (Fig. 675). But little pus appears as I divide the pedicle, and this is taken care of by our suction machine and by sponging. You see I have had to insert eight of these suture ligatures, and now I am at the last bit of tissue which holds the lobe. Dividing this, we have the specimen in our hand (Fig. 676). I have not cut any of my silk ligatures short and they have all been left long enough to protrude from the wound when it shall

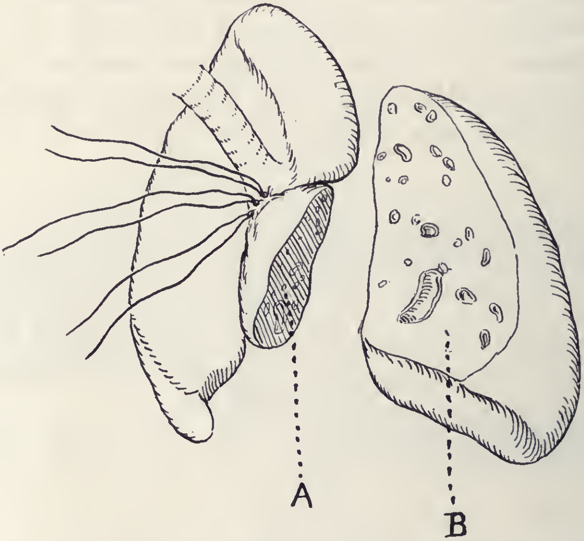

Fig. 675.—Diagrammatic drawing to illustrate method of lobe resection. Note chain ligatures of silk with the ends left long. *A* is the surface of the very generous stump which is left when the lobe is cut away. It shrinks in area as soon as it has been cut through, while *B*, the corresponding surface of the resected portion, expands in area when the lobe is severed from its attachment. The stump, of which *A* is the section, sloughs and comes away with the ligatures.

have been closed. I do this so as to steady the mediastinum by fastening the protruding ligatures in place with moderate tension, using a large safety-pin outside the chest wall to transfix the mass of silk threads. The rapid flapping to-and-fro motion of the unsupported mediastinum is an extremely dangerous thing, but it requires only a light traction to hold the mediastinum steady and to permit easy respiration. Examining the stump

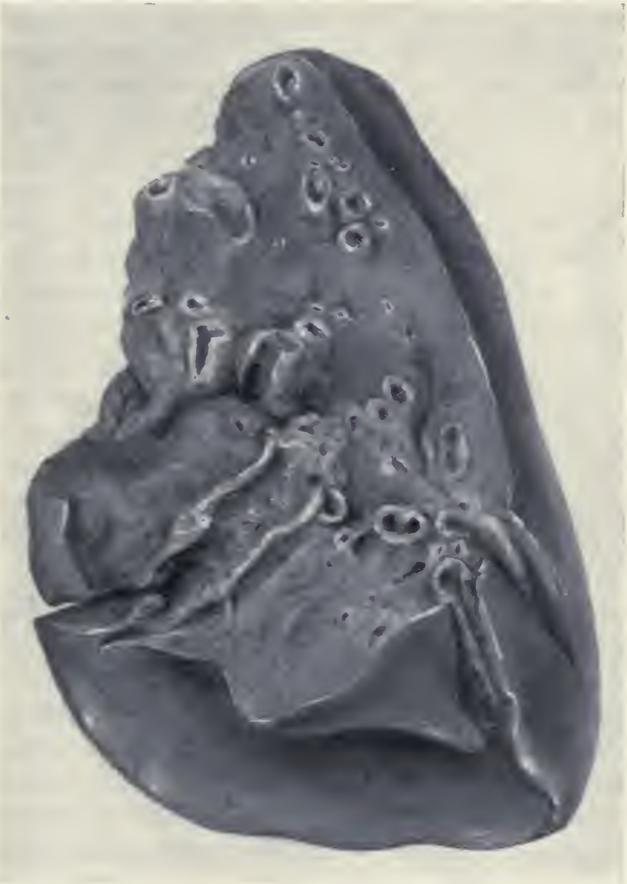

Fig. 676.—Drawing from specimen in the case of Mrs. M. Note greatly dilated bronchi.

now I see that there are a number of greatly dilated bronchial openings. We will disinfect each of them with a drop of pure phenol. At the suggestion of Dr. Neuhof, who has so skilfully assisted me during this work, I shall make a small opening in the middle of a large piece of rubber-dam and through this opening I shall draw the ligatures so that the stump may be pulled through the hole also, and thus in a measure be isolated from the remainder of the chest cavity. You observe this has worked out very nicely, and I will lightly fill this rubber bag with iodoformized gauze. Before closing the chest it is necessary to make a counteropening in the lower part of the back through which a drainage-tube shall be led from within the chest to a vessel of antiseptic solution beside the bed when the patient shall go back to her room. Therefore I make this little opening posteriorly above the tenth rib, and I select a piece of drainage-tube so large that it will fit air-tight. We will now close this large wound. First the ninth and seventh ribs are drawn together by pericostal sutures of strong chromicized catgut; then the muscular layers are brought together with small chromicized catgut put in by interrupted suture. A sufficient number of these sutures are inserted to make the wound air-tight so that sucking does not take place, but I have learned that it is dangerous to close the skin in cases of this kind. There is always sure to be a certain amount of infection, often from anaërobes which are present in the bronchi, and if drainage is not most thorough a quickly fatal infection may occur. You will note that I am burying the safety-pin, the gauze, the rubber-dam, and the ligatures beneath the layers of muscle, for I wish to have the chest air-tight except at the place where the drainage-tube protrudes, and this will be taken care of by the immersion of the tube as just described. In a few days I hope to expose them by removing the overlying stitches. The patient by this time will have adjusted herself to the strange pneumatic conditions. Dr. Branower now makes a gentle intrapharyngeal pressure and I will hold the end of the tube beneath the surface of water. Bubbles appear. Now they have ceased, and I clamp the tube for the time being until the patient shall be back in bed. You see her condition is excellent; her color is good; her pulse only about 110 and of good quality.

Postoperative Note.—Twelve hours after the operation there was a sharp reaction, with temperature of 104° F., a not unexpected phenomenon in cases of this kind. Her pulse was strong and about 130 in rate. This postoperative hastening of the pulse is also usual; often it runs as high as 160, but this need not cause alarm so long as the tension is sufficient. Thirty-six hours postoperative, however, the patient's condition was not so favorable, although she was strong and able to cough and expectorate mucus without effort. The sputum was no longer purulent and the foul odor had gone. There was, however, some cyanosis and dyspnea on comparatively little effort, such, for example, as changing the dressings. Then there appeared a complication which I had never before seen in any of these cases. I have performed lobectomy twenty-three times with eleven deaths, the surviving patients being, as a rule, entirely cured, and I have noted most of the postoperative symptoms pretty closely. Here, however, there was something new. An almost continuous belching of enormous quantities of gas accompanied by brownish-black, foul fluid brought up in small amounts.

There was tremendous abdominal distention, and in spite of gastric lavage and the usual efforts at stimulation the patient did not rally. The abdominal distention was at first relieved by a rectal tube with irrigations, but the belching continued until she died about fifty-nine hours after the operation. This belching was something entirely new to me. The quantities of gas were enormous, almost unbelievable, and, unfortunately, we were not able to discover the actual cause of death because no postmortem examination was permitted. The abdomen had not been invaded in the slightest degree at the operation, and I was at a loss for a diagnosis. One of the nurses had noted during the cleansing of the patient's mouth that there was an ulcer on the right side of the tongue about two-thirds of the way back, and the patient stated that she had had this ulcer "for a long time."

A few days after the death of the patient Dr. Neuhof happened to meet a physician who resided in the tropics who stated in regard to a fatal abdominal case of Dr. Neuhof's that he believed that the disease from which Dr. Neuhof's patient died was sprue, which is endemic as a visceral disease in the West Indies. A fatal exacerbation of the condition, peritonitic in character, frequently occurs after any serious operation, no matter what its character may have been, and in the Antilles this is so well known that in the presence of sprue one does not operate except in emergencies. Dr. Neuhof suggested that this might have been the case with my patient, and I then recalled the indolent ulcer of the tongue. Unfortunately, no culture was made. As soon as I knew of the possible complication of sprue I requested Dr. Aschner, who had the lung specimen for examination, to try to isolate the Monilia. This, however, was impossible because the specimen had already been put into an antiseptic preserving solution.

CHRONIC LEFT EMPYEMA WITH THORACIC FISTULA. MAJOR THORACOPLASTY AND LUNG MOBILIZATION

Our patient today is a youth of sixteen, tall and well developed, but, as you see, frightfully scoliotic from a contracted left thorax the result of long-continued suppuration in the left pleural cavity. He was sent to me by Dr. J. Knox Simpson, of Jacksonville, Florida, and I first saw him only two days ago. His thoracic troubles began at an early age, for when he was but eighteen months old he had a left-sided pneumonia. His tonsils and adenoids were removed five years ago. On February 1st of last year he had influenza with pneumonia, followed by a left empyema, which was operated upon by intercostal thoracotomy in March of the same year. He was relieved, but the wound never closed in spite of the best of care. The following autumn he was treated by the Carrel-Dakin method for ten weeks, but without radical change in his condition. During the ten weeks he received instillations every two hours.

At the time of his first visit there was profuse discharge, and to make himself comfortable he wore a tight-fitting tube clamped so as to prevent the outflow of pus except at the time of the dressing. I found the fistula in the left axillary line in the seventh interspace. The condition is well demonstrated in this *x*-ray plate (Fig. 677). You will note the great scoliosis, the large irregular pneumothorax in the left chest, and the pleural thickening.

In spite of this boy's mature development I believe there is still time to correct in part at least the scoliosis by operating upon his chest and closing his sinus.

Dr. Harry Goldman is administering the anesthetic for us and is using nitrous oxid and oxygen with a little ether. He has the necessary apparatus for intrapharyngeal insufflation should it become necessary.

The patient is placed upon his right side and the bridge of the table is elevated so as to give as good access as possible to the intercostal space where we expect to begin our incision. This position is a very important factor in securing a free exposure of the thoracic cavity. It is better to spend a little time in getting the patient exactly in the right position than to have to shift him about later on. In opening a thorax of this kind in the presence of a sinus I pay no attention to the location of the opening of the fistula, but prefer to make my incision as if no wound were present. If the fistula happens to be in that interspace which seems most advantageous for the first incision, I go right through it; if not, I enter the chest above or below it, as the case may be. In the present instance you see I have made my skin incision between the seventh and eighth ribs, the sinus being one space above. You will note that my incision begins well behind the costal angles and extends forward almost to the

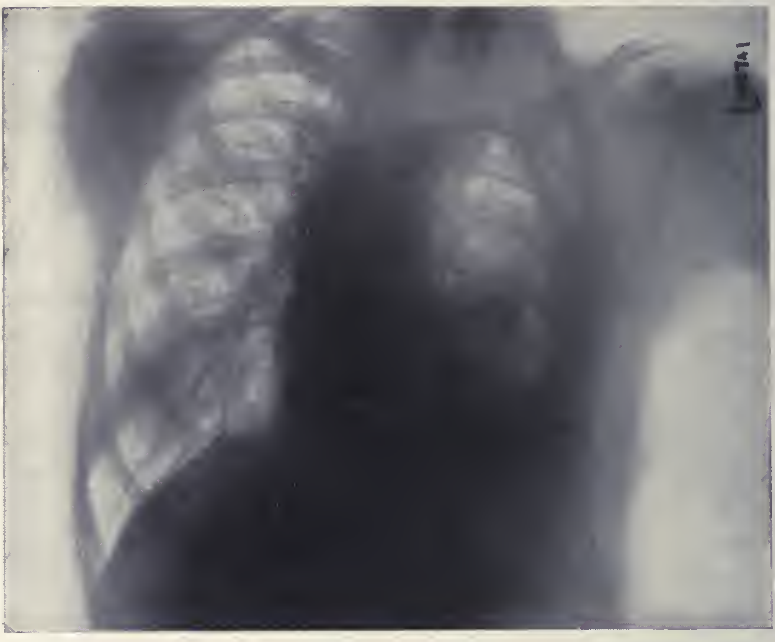

Fig. 677.—Case of C. McK. This x-ray picture shows the scoliosis, the great contraction of the left chest, and the empyema cavity represented as a pneumothorax.

cartilages. The serratus magnus and latissimus dorsi are divided and the vessels crossing the incision are quickly clamped on both sides of the wound. We are now down to the ribs, and I find the seventh much deformed on account of the long presence of the tube, which has caused osteomyelitis with bone production. I can see already that we shall not have room in this contracted chest to expose all the recesses unless we divide some of the ribs, so I quickly extend the incision up along the posterior border of the scapula, dividing skin, trapezius, and rhomboid muscles, and then with a large-sized Liston's forceps I divide the sixth and fifth ribs posteriorly and insert two rib-spreaders, one in the original wound, the other between the cut ends of the sixth and fifth ribs (Fig. 669). In this way we gain a perfect exposure of the cavity. You will see that it is smooth-walled but irregular in shape, and it evidently is of about 500 c.c. capacity. The glistening lining, grayish in color, is not as thick as we often find it in these cases, probably because of the long treatment with Dakin's solution which has dissolved much of the exudate, but the lining is extremely tough and extends equally over the visceral and parietal pleura, so that all landmarks are obliterated.

Under the guidance of the eye I now make an incision with the scalpel beginning at the uppermost part of the chest directly upon the lung side, and this incision extends down to the lowermost part of the cavity. Ordinarily one would expect this incision, which completely divides the exudate, to spread with the respiratory movements of the lung, and this, you see, is the case here. The incision has become spindle shaped and about ½ inch of lung shows through. There is, however, no line of cleavage between this tough fibrous material and the lung itself. Evidently fibrous prolongations extend down into the lung tissue, so that if we should try to peel it away there would be much bleeding and bubbling, and considerable lung tissue would be torn off and would come away with the exudate; therefore we will make three other incisions parallel to the first one, and five or six incisions across these, as suggested by the late Dr. Joseph Ransohoff, of Cincinnati. This is not a scarification, but each incision penetrates through the entire thickness of the confining membrane, and even a tiny bit into the lung, so as to make sure that we gain all that is possible in expansibility.

Dr. Goldman will now apply air pressure through a nasal tube which extends into the pharynx, at the same time closing the opposite nostril with his finger and also closing the patient's lips. It is interesting and most gratifying to see now how the lung gradually becomes inflated, so that finally all except the extreme lower part has completely filled the chest, and instead of a 500 c.c. cavity we have lung in contact with chest wall. I will dissect away here and there some of the little islands left by the cross-hatching incisions, using forceps and scissors. The patient's condition being excellent, I will try to dissect the lower lobe free from the diaphragm, and here we find a good line of cleavage, so that the lower surface of the lobe is nicely freed. Even so, however, it does not quite bulge to the chest wall. I think that when blowing exercises are begun the patient will be able to fill his chest completely. I will place a little drainage-tube at the anterior part of the chest where we have resected a part of a rib and also posteriorly above. These tubes will be used for postoperative treatment by means of the Carrel method. We will now close this large wound. No great effort is made to bring the ribs together, but the muscles are sutured with interrupted catgut stitches which narrows the widened intercostal space and also approximates the skin edges to within about $\frac{2}{3}$ inch of each other. This narrow wound we pack with iodoformized gauze, and in three or four days the gauze will be removed and the wound closed with strips of adhesive plaster.

I told this boy's father that if all went well his son should be discharged in four weeks from the time of operation. I arrived at this conclusion from the treatment of many cases by this method. I began at Bellevue Hospital in 1916, and during the War, at Base Hospitals Nos. 3 and 101 in France, I had the opportunity to test the method out very thoroughly. I found that in most cases in which there was no complication healing was complete in about four weeks. Often the external wound closed soundly in the presence of a certain degree of pneumothorax, which gradually became obliterated. So I felt safe in making my promise so far as a surgeon can promise anything. We will now dress the wound with plenty of gauze and hold it in place with adhesive strips, no bandage or strap encircling the body.

Postoperative Notes.—No shock followed this operation; the patient began his blowing exercises the same night. Three days later treatment by the Carrel-Dakin method was begun. The upper tube was removed in three weeks and the lower one was left out on July 21st, about four weeks after the operation, five or six smears taken from the end of the tube from the inside of the chest cavity having shown that no discoverable organisms existed. I often make cultures from the tubes in these cases, but this cavity was not large, and I judged it would probably

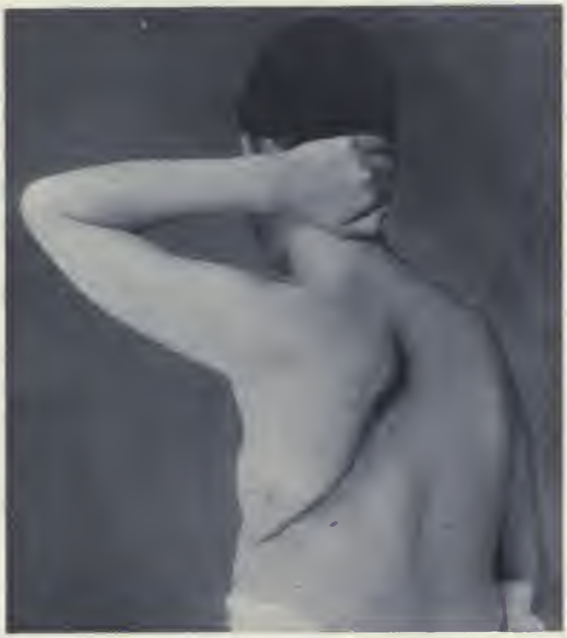

Fig. 678.—C. McK. Wound completely healed. Note original small thoracotomy scar above anterior part of main scar.

take care of a few bacteria so long as no streptococci were present. On July 25th, exactly one month from the time of the operation, the patient was discharged from the hospital with a tiny granulating area still present. I kept him under observation for a few weeks and then sent him back to Jacksonville in splendid condition. A recent letter from his father states that the cure is apparently complete (Figs. 678, 679).

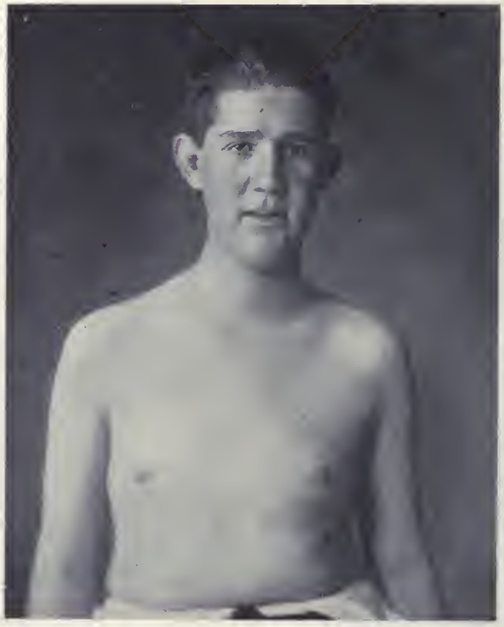

Fig. 679.—Same patient as Fig. 678, four months after operation, showing great improvement in the scoliotic deformity. Unfortunately, there is no preoperative photograph.

MULTIPLE RESECTION OF RIBS WITH COLLAPSE OF CHEST FOR PULMONARY TUBERCULOSIS

Dr. Lawrason Brown, of Saranac Lake, kindly referred this patient to me. She is Miss Marie F., twenty-four years old, who has been ill for some years with tuberculosis. I need not go into the details of her history, but I will say that at present she weighs only 79½ pounds, that her general condition is extremely poor, that there is cough with slight expectoration, and distress from shortness of breath, etc. The *x*-ray examination made at the Trudeau Sanatorium showed the presence of well-marked tuberculosis in the right lung, with extensive disease of the left, in the upper part of which was a large cavity of the left lung, irregular in shape (Fig. 680). Owing to adhesions and pleurisy Dr. Brown did not believe that artificial pneumothorax could be produced and advised surgical collapse of the left chest. When she entered this hospital (Flower) on July 18th I found her pale and slightly cyanotic, with a weak pulse of about 130 and temperature of 101° F. The case did not look surgically promising to me, but neither was the outlook brilliant without the operation. I explained the matter very carefully to the patient's family, and their decision was for operation. The patient herself readily consented, and here she is.

I intend to perform the operation as nearly as possible by the method used by Sauerbruch, which appears to me to be as safe as any procedure in a disease of this kind can be. It does not expose the lung or open the pleural cavity, and there is the further advantage that we can stop the operation at almost any stage, completing it later.

Dr. Branower is administering the anesthetic—gas and ether—by the ordinary closed method without intrapharyngeal pressure, and Dr. Harold Neuhof is assisting me. Doing work of this kind it is most important that the first assistant shall be himself a skilled surgeon because much depends upon speed without haste. You will see that while I am operating Dr. Neuhof is not only assisting, but is operating also.

The patient being now under the anesthetic, Dr. Neuhof is injecting 15 c.c. of a 30 per cent. sodium citrate solution into each buttock after a method devised by himself for lowering the coagulation time of the blood.

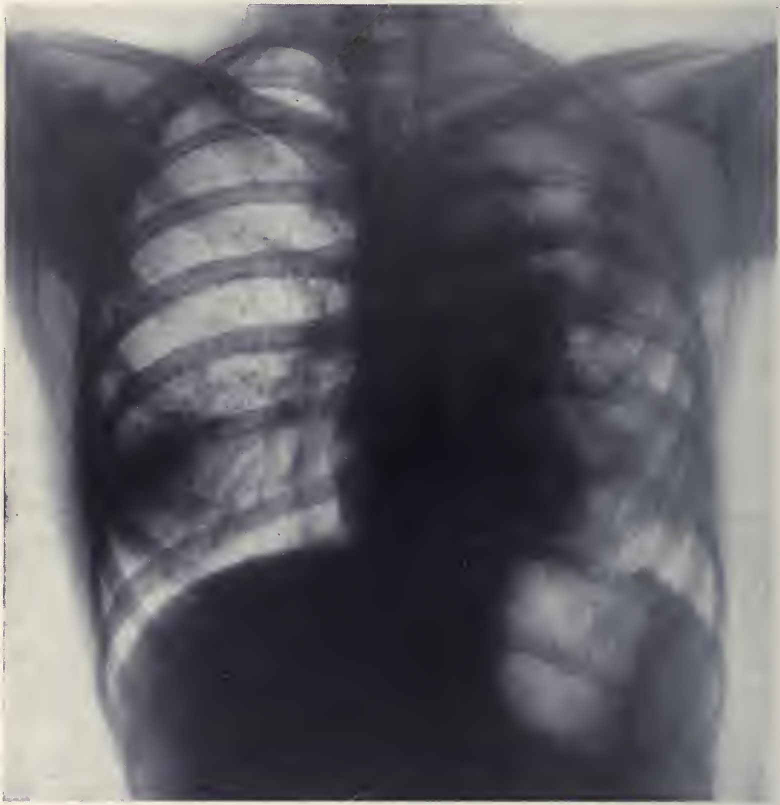

Fig. 680.—Preoperative *x*-ray in the case of Marie F. Far advanced tuberculosis of left lung with large cavities at apex. Note also generalized lesions of right lung.

We will now turn the patient so that she is lying partly over on her face, the plane of the back being at an angle of about 45 degrees with the horizontal, the chest and abdomen being supported by sand-pillows. Our incision begins at the level of the second rib and follows the course of the spine about 2½ inches away from it downward to the eighth rib, where it curves slightly forward. The left arm and shoulder are drawn forward so that the scapula is as far out of the way as possible. We quickly divide the muscles of the back, exposing the third, fourth, and fifth ribs. These are now resected subperiosteally, removing from 1 to about 4 inches of each, smaller amounts being taken from the upper ribs than from the lower ones. Now the second rib is divided, and with great care having extended

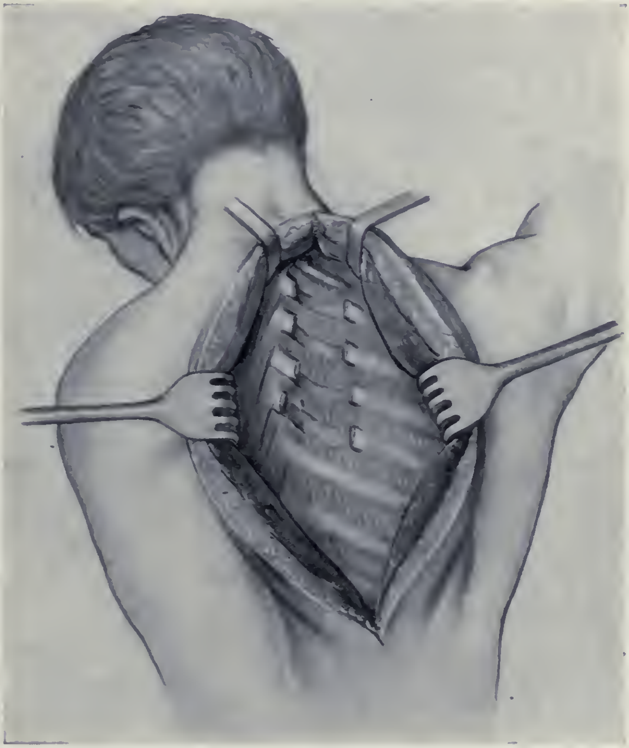

Fig. 681.—A drawing representing Sauerbruch's multiple paraspinal rib resection for collapse of the chest. The second, third, fourth, and fifth ribs have been resected. The first, sixth, seventh, and eighth are still to be resected. The posterior stumps are finally cut away to the spine itself.

the incision upward, I am able to make a 1-inch resection of the first rib also. Dr. Branower reports the patient's condition as excellent, so let us continue and resect the sixth, now the seventh, and then the eighth. With the rongeur we will now remove all the remaining posterior parts of the resected ribs to the spine itself, except the first rib. You see this is not a difficult matter with the exposure afforded and with the pleura not opened, but

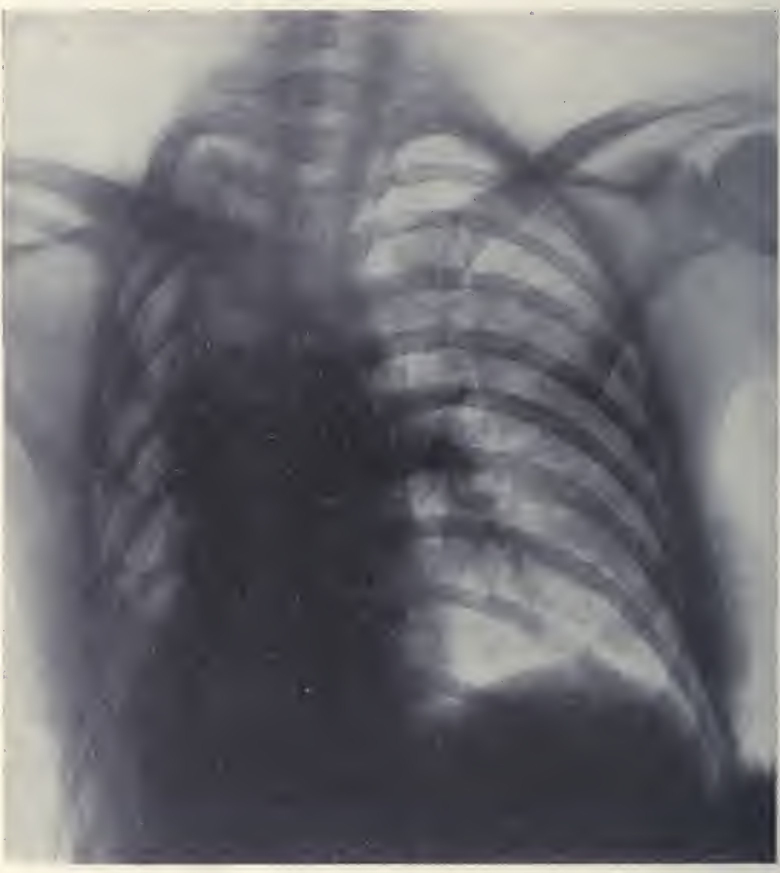

Fig. 682.—Compare with Fig. 680. Same case three months after operation. Note great contraction of left chest and the bony bridge connecting the divided ribs.

with the first rib this promises to prolong the operation, so we will rest satisfied with the 1 inch which was originally taken away. A long split-rubber drain extending the entire length of the wound is put in place, and then the divided muscles and fascia are brought together with sutures of chromicized catgut.

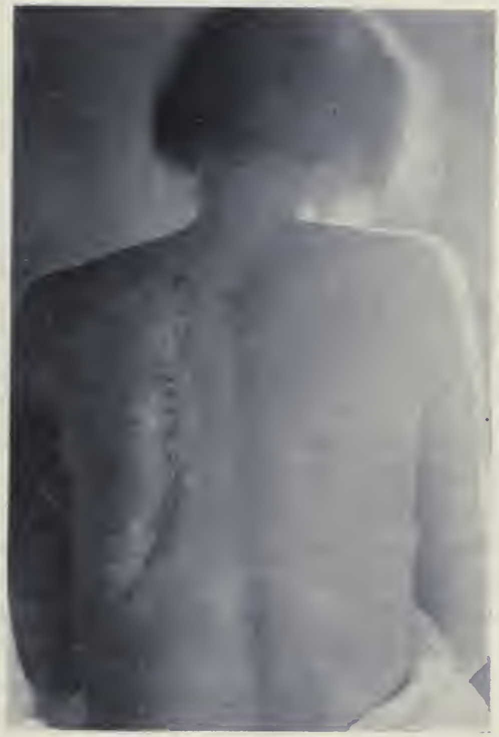

Fig. 683.—Photograph two and a half months after thoracoplastic collapse of left chest for tuberculosis. Patient is greatly improved. Temperature normal. No sputum. Slight cough still present. Gain of 11 pounds in weight.

This operation having been presumably clean, I think we may take a chance on suturing the skin, and for this we will use fine silk. The dressing of gauze is put in place, and you will note that we are not using a bandage for fear of too greatly embarrassing the respiration, but will hold the dressings in place with long adhesive plaster strips which do not completely encircle the body. We must not forget that the other lung is also seriously diseased.

Postoperative Notes.—Some shock followed the operation, but seven hours later Miss F. had revived nicely and was in excellent spirits, complaining of no pain, although the tight adhesive dressing annoyed her. Two days later the nurse reported that the patient had coughed and expectorated only once since the operation. Her temperature rose to 101.4° F. and the pulse to 132. She was put on digitalis therapy as a prophylactic. Three days after operation I discovered that the entire wound was mildly infected, so I thought it best to remove the sutures, and this promptly relieved absorption symptoms. The left chest was compressed by means of adhesive plaster strips, each with an inset of strong rubber bandage.

A few days later I left New York for my vacation and Dr. Neuhof took charge. The patient made a rapid surgical recovery, and on my return to New York in September I found her condition excellent, the wound firmly closed, a gain of 7 pounds in weight, and scarcely any cough present. The temperature is normal.

The photograph (Fig. 683) and the reproductions of the x-ray pictures will give a good idea of the amount of compression secured, but it will be noted that the resected parts of the first and second ribs have been reproduced by new bone. Probably a resection of first and second ribs with the periosteum would in a measure have prevented this, although any resection short of $1\frac{1}{2}$ inches even when the periosteum is also taken is apt to be followed by regeneration of bone.

Note.—December 3d: Miss F. has returned to her home. There has been a further gain in weight and she continues to improve.

CLINIC OF DR. RICHARD LEWISOHN

Mt. Sinai Hospital

PENETRATING ULCERS OF THE LESSER CURVATURE OF THE STOMACH

Etiology of Gastric Ulcers. Some Diagnostic Points of Interest. Discussion of Different Surgical Procedures. Report of Four Cases Cured by Partial Gastrectomy.

In the following presentation I will consider the subject of ulcers situated at or near the lesser curvature of the stomach between cardia and pylorus. I do not present for consideration those ulcers which are situated at the pylorus or in the duodenum.

Compared with pyloric and duodenal ulcers, which are very frequent, the ulcers of the lesser curvature of the stomach are comparatively rare. However, they do not present a curiosity. In fact, their occurrence is sufficiently frequent to warrant a short discussion as to etiology, diagnosis, and treatment.

The etiology of these ulcers is as obscure as that of the pyloric and duodenal ulcers.

Rosenow (Production of Ulcer of the Stomach by Injection of Streptococci, Jour. Amer. Med. Assoc., 1913, 61, 1947) demonstrated about five years ago the possibility of an infectious origin of gastric ulcers (streptococci).

Reeves (A Study of the Arteries Supplying the Stomach and Duodenum and Their Relation to Ulcer, Surg., Gyn., and Obst., 1920, 30, 374) has published interesting anatomic studies, showing the close relation of ulcers to arterial vessels, which branch off from the main gastric arteries and pierce through the wall of the stomach. There are many other theories on the causation of gastric ulcers. Many authors in the recent literature assume a close relation between the endocrines and the formation of ulcers. None of these different theories is definitely proved as the causative factor. None of them gives an explanation for the vast preponderance of the occurrence of gastric ulcers in male as compared to the female sex.

The existence of a large number of gastric ulcers in the male sex holds good for the penetrating ulcers of the lesser curvature as well as for the pyloric and duodenal ulcers. Of course exceptions make the rule. However, generally speaking, ulcer of the stomach is the most frequent upper abdominal disease in the male, cholelithiasis in the female.

The patient usually gives a history of epigastric distress, extending over many years. Marked periodicity of symptoms occurs in penetrating ulcers of the lesser curvature of the stomach, as well as in pyloric or duodenal ulcers. These patients are often free from symptoms for periods of from six to nine months. They consider themselves cured until a sudden severe relapse demonstrates that their improvement was of temporary nature only.

The epigastric distress is often very severe. The pains are usually located under the xyphoid process, radiating to the left side. The patients often complain of pains in the precordial region. I have seen patients who were treated for heart disease for years, yet the *x*-ray proved conclusively that the so-called angina attacks were only referred pains and that they suffered from a penetrating ulcer of the lesser curvature. In another case appendectomy had been performed some years previously without relief of symptoms. Gastric resection cured this patient.

The pains usually occur a short time after eating, at a much shorter interval than in pyloric or duodenal ulcers. Sour eructations are very frequent, vomiting is comparatively rare. Occasionally we find occult blood in the stools as a symptom of an ulcerative process in the gastric mucosa. In other instances we encounter a profuse gastric hemorrhage as the first serious symptom, caused by erosion of a large blood-vessel in the bed of the ulcer-bearing area.

It is evident from this short description that the symptoms caused by penetrating ulcer of the stomach are practically iden-

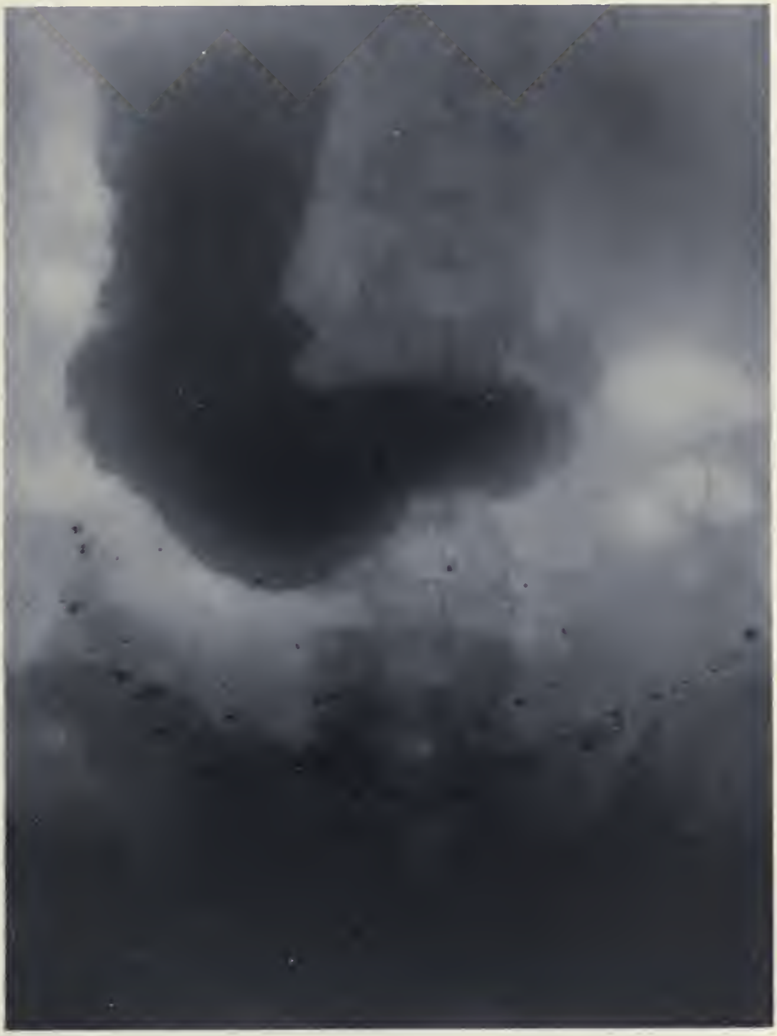

Fig. 684.—Patient H. S. Roentgenogram showing penetrating ulcer of the lesser curvature of the stomach. This illustration should have been reversed, showing the stomach on the left side.

tical with those caused by pyloric ulcers. It is fairly easy, in the majority of instances, to make a diagnosis of gastric ulcer from the clinical symptoms. However, it is impossible to accurately diagnose the exact location of the lesion without the aid of roentgenoscopy or roentgenography.

The *x*-ray examination shows the typical excavation at the lesser curvature of the stomach (Fig. 684).

The *x*-ray diagnosis is pathognomonic for this disease, as no other method of investigation can definitely settle the location of the ulcer. It must, however, be borne in mind that the demonstration of the excavation (so-called "Haudeck's niche") does not exclude the possibility of a malignant growth.

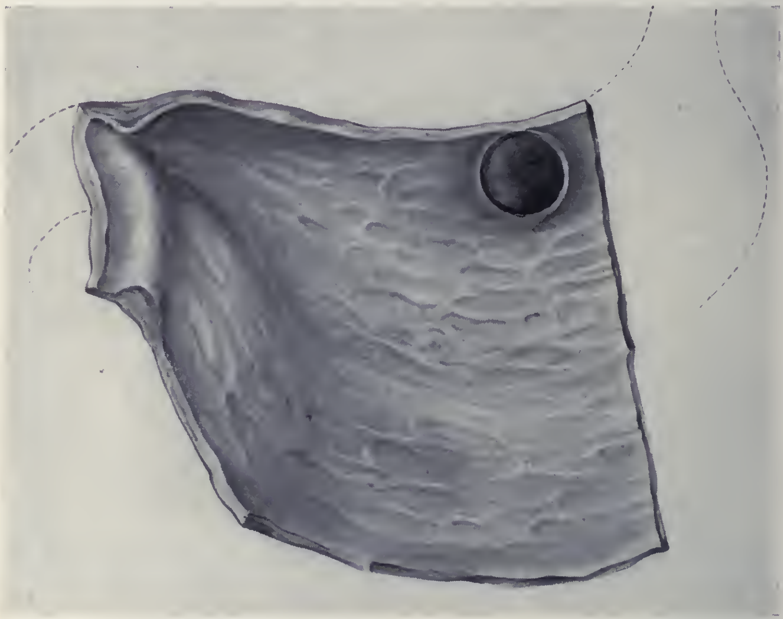

Fig. 685.—Same patient. Specimen of penetrating ulcer removed by partial gastrectomy.

The *x*-ray picture shows in many cases an hour-glass formation of the stomach. This hour-glass formation is often simple reflex; in other cases it is formed by a large ulcer extending over the posterior wall of the stomach and thus causing a marked narrowing of the gastric lumen. In these cases only a small area of the ulcer is demonstrated on the *x*-ray picture; the largest part of the ulcer is situated on the posterior wall of the stomach and cannot be visualized in the picture. In other words, the size of Haudeck's niche and the size of the ulcer are not identical in many cases.

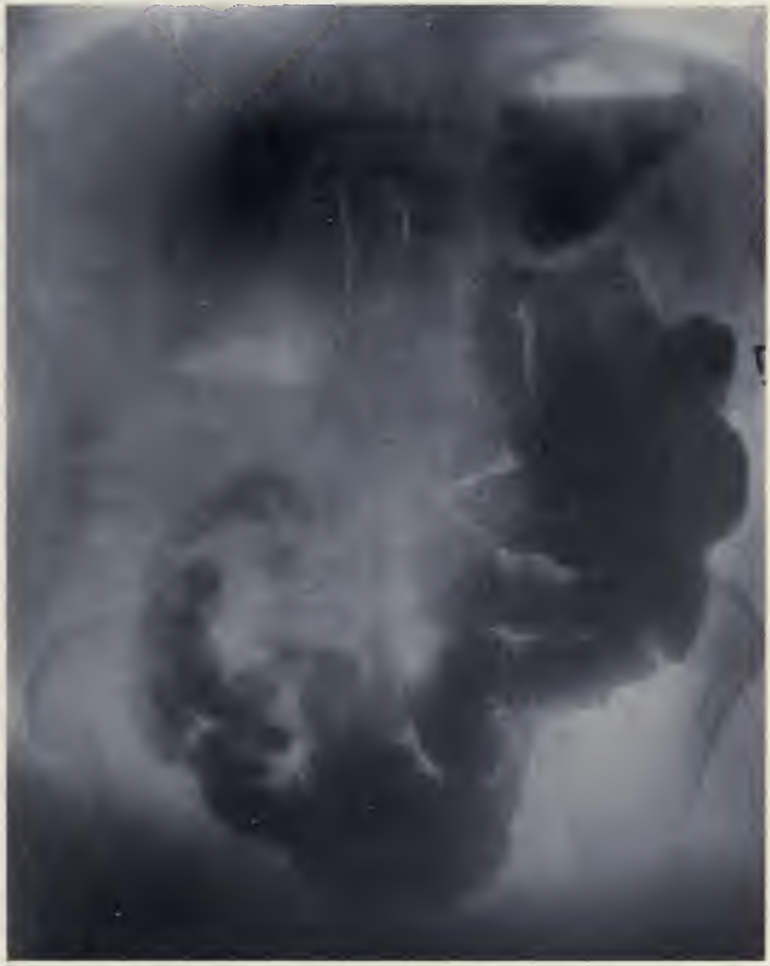

Fig. 686.—Same patient. Roentgenogram showing size of stomach one year after partial gastrectomy.

This point is shown very well if we compare Figs. 684, 685.

Figure 684 shows a comparatively small defect. Figure 685 shows the real size of this ulcer, as demonstrated in the specimen (after partial gastrectomy).

The patient made an uneventful recovery (operation twelve months ago) and is completely relieved of his symptoms, though at least two-thirds of his stomach had been removed at operation (Fig. 686).

The *x*-ray examination further shows a marked six-hour residue in some instances. This residue is usually caused by pyloric reflex, not by a real obstruction at the pylorus.

The chemical investigation of the gastric contents plays a rather unimportant rôle as compared with the personal history of the patient and the *x*-ray findings. Marked hyperacidity may be considered as corroborative evidence. However, the lack of reliability of the chemical data is best demonstrated by the fact that I have seen several cases of microscopically proved benign penetrating ulcers of the lesser curvature of the stomach with marked hypo-acidity and even complete anacidity.

The treatment of penetrating ulcers of the stomach is purely surgical. Medical treatment may alleviate the symptoms occasionally, however, but it can never cure these ulcers. Anybody who has seen a large number of these punched-out gastric defects will agree with me that no medicine or diet can have any marked influence on these ulcers.

The operative methods for the cure of penetrating ulcers of the lesser curvature have become more radical during the last few years. Formerly simple gastro-enterostomy was deemed sufficient to cure these ulcers. However, it has been definitely proved that gastro-enterostomy will not cure ulcers of the lesser curvature. I have seen 2 cases in which the ulcers persisted in spite of a previous gastro-enterostomy performed in other hospitals. Both cases were cured, one by local excision, the other by partial gastrectomy.

Another procedure which formerly was employed in ulcers of the lesser curvature was the so-called sleeve resection. Though immediate results of this operation are very good, the patients are not permanently cured. They usually develop an hour-glass formation of their stomach a few months after the operation. For this reason sleeve resection ought to be definitely abandoned.

The same complication (hour-glass formation) follows simple excision of the ulcer, no matter in what direction we apply the sutures in order to close the defect.

A method which is still very popular among surgeons is the local excision combined with gastro-enterostomy. This simple method, which I have used in 6 cases, has given good results. All these patients made uneventful operative recoveries. However, their final results were not nearly as good as in those cases in which I performed a partial gastrectomy.

The best end-results are undoubtedly obtained by partial gastrectomy. However, this method must be used only in those cases in which the ulcer is situated either near the pylorus or midway between pylorus and cardia at the so-called re-entrant angle. When the ulcer is situated at or near the cardia gastrectomy would represent too formidable a procedure. For these cases local excision (or Balfour's cautery excision) with or without subsequent gastro-enterostomy is the most advisable procedure.

It seems undoubtedly a rather formidable procedure to remove one-half or even two-thirds of the stomach, though the size of the ulcer is often not larger than a dime. Yet experience has shown that end-results following partial gastrectomy are far superior to those obtained by other methods. My personal experience with partial gastrectomy for penetrating ulcers of the lesser curvature is limited to 4 cases. All these patients made an uneventful operative recovery and left the hospital two weeks after the operation. They are in excellent health now (2 patients were operated over a year ago, the others are of more recent date). They are absolutely free from symptoms, though in 2 cases about two-thirds of the stomach was removed at the time of operation.

The great advantage of partial gastrectomy is based on two facts: (1) It safeguards against hour-glass formation, and (2) it prevents formation of subsequent ulcers by the removal of the antral and pyloric portion of the stomach. Furthermore, this method seems to prevent formation of gastrojejunal ulcers, as gastrojejunal ulcers are very uncommon in cases where the antrum of the stomach and the pylorus have been removed.

The following operative procedure was employed: After ligation of the vessels the lesser omentum was entered and some slight adhesions between the posterior wall of the stomach and the pancreas were freed. The stomach was divided proximally to the ulcer on one side and just distally from the pylorus on the other side. It is very important, in order to secure a safe closure of the distal stump, to carry the resection beyond the pylorus. Gastric and duodenal stumps were closed with three layers of chromic catgut. Before closing the gastric end one-half of a Murphy button was dropped into the remnant of the stomach. The other part of the button was inserted into the jejunum in typical fashion. A very small stab was then made into the posterior wall of the stomach. The gastric half of the button was pushed through this opening and stomach and jejunum were thus united. The abdominal wall was closed in layers without drainage. The button was passed per rectum without causing any trouble in these 4 patients.

I would like to say a few words about the application of the Murphy button in gastric resection. The button was used extensively for many years. In fact, its construction by the late Dr. Murphy was one of the important factors in the development of modern gastric surgery. However, there has been a tendency to discredit the use of the button during the past few years. A number of surgeons strongly advise against the use of it. According to them the button is of historic interest only.

It seems that such a radical point of view is not warranted by facts. The button still has its place in certain selected chapters of gastric surgery. There can be no doubt that by using the Murphy button instead of suture gastro-enterostomy we can increase our indications for resection of the stomach materially. It is very easy thus to re-establish the gastro-intestinal continuity even when a very small portion of the stomach is left after resection and suture. By using the gastric half of the button as a guide the stomach can be drawn down easily and united with the jejunum without any tension.

Occasionally the button will stay in the stomach, thus requiring a secondary operation. With the use of the Weir modification of the Murphy button this is a rare occurrence.

Many surgeons use the Polya-Balfour method in preference to gastro-jejunostomy. Haberer (Anwendungsbreite und Vorteile der Magenresection Billroth I, Arch. f. chir., 1920, 114, 127) has used the Billroth I method in a large number of cases.

Resection of the stomach in uncomplicated cases of penetrating ulcer of the stomach is undoubtedly a very simple procedure. However, in complicated cases with extensive adhesions this operation can be very difficult.

In one case the ulcer occupied a large portion of the posterior wall and was so densely adherent to the pancreas that the base of the ulcer was left attached to the pancreas. In case of extensive adhesions on the posterior aspect the stomach is completely divided on the proximal side before the division of adhesions is attempted. The separation of adhesions can then be performed under the guidance of the eye—a much safer procedure.

This case—technically the most difficult of the four operations—had very large glands along the lesser curvature and in the transverse mesocolon which aroused a suspicion of the malignant nature of the ulcer. If it were a carcinoma this case would have been inoperable on account of extensive glandular involvement. However, it was decided to give the patient the benefit of the doubt. Microscopic examination showed benign ulcer. The glands showed inflammation, but no malignancy. This patient feels perfectly well now, one and a half years after the operation.

When patients have suffered from profuse hemorrhages they should be given the benefit of a preoperative transfusion of blood. Their chances for smooth postoperative course are thus decidedly improved.

In rare instances we meet very large ulcers so densely adherent to the surrounding tissues that their radical removal is out of the question. In such cases jejunostomy may be performed with advantage. The complete side-tracking of the food for one to two months gives these ulcers a chance to heal. I have seen a case of perforated ulcer of the anterior wall of the stomach (with an abscess in the abdominal wall) which was cured by temporary jejunostomy.

The postoperative course following the resection of the stomach has to be watched with great care. It is advisable to give the patients a subcutaneous injection of saline solution immediately after the operation. This injection is repeated the same evening and possibly the following day. If the patients vomit a great deal or complain of epigastric distress a stomach-tube (without lavage) is passed the next day. This usually relieves the patient considerably. Water by mouth is given forty-eight hours after the operation, first in very small quantities.

From the third or fourth day fluids are given in larger amounts, to be followed by semisolid food by the end of the first week.

The after-treatment is of the greatest importance. These patients have to keep a strict diet (with avoidance of fats and acids) for at least one year. In this way only can we obtain good end-results.

Rapid progress has been made in the last few years in the surgical treatment of penetrating ulcers of the lesser curvature. Experience shows that the radical removal of these ulcers is the proper procedure in the majority of cases and represents one of the most gratifying chapters in gastric surgery.

CLINIC OF DR. JOHN J. MOORHEAD

FROM DIVISION OF TRAUMATIC SURGERY, POST-GRADUATE HOSPITAL

"TRAUMATIC"(?) INGUINAL HERNIA

PATIENT is thirty-two years old, mechanic, born in United States; weight now 160 pounds; height 5 feet, 9 inches.

Chief Complaint.—Lump in right groin. Duration seven weeks.

Family and **past histories** are unimportant.

Present History.—Seven weeks ago while at work he lifted a heavy piece of metal and felt that he had "strained himself" in the lower part of his abdomen. No severe pain. No nausea. Continued at work. That night noticed a "lump" in his right groin the size of a marble. This disappeared during the night, but reappeared during the day, and grew larger during the following weeks. It causes no pain. It disappears when he lies down or when he presses upon it. Coughing, straining, or lifting causes the lump to increase in size.

Examination shows an egg-sized swelling in the right inguinal region close to the external abdominal ring. Direct pressure causes the lump to disappear; it does not reappear when he strains if the external ring is pressed upon through the abdominal wall or by invaginating the scrotum. The lax external ring admits the thumb. There is no protrusion along the opposite inguinal canal or in the femoral or umbilical regions. No varicocele. No hemorrhoids. General examination otherwise normal.

Diagnosis.—Indirect inguinal hernia, third degree or + + +.

Remarks.—The external ring is normally large enough to admit the tip of the little finger, and on straining no impulse is apparent. For purposes of classification we can say that there are *four degrees* of inguinal hernia; and "hernia" is, in reality, only another name for ptosis.

First degree hernia means that the ring is dilated enough to admit the index-finger-tip and an impulse is present. This is designated +.

Second degree hernia means that the ring is still further dilated, impulse is present, and a palpable mass appears at the ring. This is designated + +.

Third degree hernia means that all the elements exist as in the second degree, and, in addition, there is a visible mass at either ring or along the canal. This is designated + + +.

Fourth degree hernia means that the mass enters the scrotum. This is designated + + + +.

In the advanced degrees the size of the mass may be designated by comparison with any chosen globular object; for example, a walnut, egg, etc.

Given, then, some standard as to the "degree" of any hernia, what is to be said as to the relation of a given injury to the production of the hernia? There are three main phases to this inquiry, namely:

(1) Is there any such thing as "traumatic hernia," one arising solely from a single act of violence?

(2) If not, how does a single act of violence affect the development of hernia?

(3) And again, what is the effect of repeated acts of violence in the production of a hernia?

Before answering any of these questions let us revert to the anatomy of the matter in terms of simple analogy. The inguinal canal with a hole at either end (which we call "internal ring" and "external ring") can be compared to the parturient cervical canal which also has a hole at either end (which we call the "internal os" and the "external os"). Both canals have normally a fixed caliber adequate to their respective physiologic demands. Under the stress of continuing intra-abdominal pressure both canals dilate until each gives birth to a something which in one case may be a fetus, in the other, a coil of intestine or omentum. In both cases the dilatation of the canal was slow in onset, progressive, impelled by the vis-a-tergo, the push from behind due to repeated or intermittent intra-abdominal pressure. Alike also is the appearance of the "mass" at the outlet. In the one case the final intra-abdominal contraction produces the fetus; in the other case the intestine or omentum. A *single* intra-abdominal contraction never causes a dilation of the cervical canal or of the inguinal canal; the process in both cases is slow, the product of a continuing, oft-repeated force. External violence causes dilatation of the cervical canal only in proportion to the amount of productive intra-abdominal pressure. The same thing applies to the inguinal canal. External violence has caused the birth of a child by virtually performing a cesarean section with accompanying laceration of the uterine or abdominal wall. The same thing has occurred when some act of violence has penetrated the inguinal canal from without, as, for example, the museum cases in which the patient has been impaled on a picket or the horns of an animal. But these things are exceptionally rare, and clinically they are not seen at the bedside or in the operating room.

We are not concerned with these cases of what may be termed "compound" hernia, in which there has been a severing of muscles and fascial planes; these are the rare events read of in the library, but not seen in practice.

To revert, then, to *question one:* Can a single act of violence cause a hernia? The answer is "no," unless the violence has caused a severing of the overlying muscular and fascial protectives.

Question two: What is the effect of a single act of violence in the development of hernia? The answer is that it depends on the individual and upon the type and place of receipt of the violence. An individual of the ptosis type is in a receptive state, his muscles are lax, his rings are open, they probably are dilated by varicosities acting virtually as a Barnes bag, and he doubtless has had a first degree hernia for years, and, indeed, he was probably born with a patent internal ring. This type of individual sooner or later will develop a hernia; *one* final act of violence associated with intra-abdominal strain may give birth to his hernia, which for years had been in a nascent state—he had, to carry out the analogy, almost arrived at "full term." Sneezing, coughing, straining of many sorts would carry him from the first degree of hernia into an advanced degree, and he doubtless would show bilateral hernia on closer examination.

The hardy individual would not be affected at all by a single or isolated act of violence, which in the ptotic type of individual caused the protrusion to appear or increase.

Hence the physique is important. Now the type of violence and the place of its receipt are also important. The essential element in the relationship of violence is, did it cause intra-abdominal pressure? If so, it may be a factor if of a grade sufficient to cause sudden widening of a ring or the canal; if so, *immediate symptoms* would appear, and these would be pain, nausea, tenderness, and later a mass and probably some discoloration. If there is no immediate onset, then the relationship is as doubtful as in an alleged case of concussion from a blow on the head in which there was no immediate unconsciousness. The point is that we cannot traumatize a piece of intestine or omentum without appropriate manifestations; try it in operating on a patient under local anesthesia, and note what happens. It is absurd to believe that a piece of intestine or omentum can be forcibly crowded into a normal ring or canal without the patient's knowing about it until hours, days, or weeks later. Yet that is the history we get in the majority of cases.

A fall on the feet, a blow on the back or chest, some *indirect* transmission of the violence to the abdomen or inguinal region is never an incident of much causal relationship. Lifting, pushing, pulling—all these may narrow the abdomen, may produce intra-abdominal pressure enough to play some part in the production of the hernia if the element of adequacy pertains; adequacy of violence, adequacy of the immediate symptoms.

Question three: What is the effect of repeated acts of violence in the production of hernia?

Here, again, it depends on the individual physique and the type of the violence. Repetition of the intra-abdominal strain is the greatest factor in the production of hernia. If, for any reason, the individual is of the ptotic or hernia type, then repeated intra-abdominal strain may be the causative factor in the production or aggravation of his hernia. Weight-lifters, wrestlers, and others of that type do not fall into the hernia class because they have a symmetric muscular development. Likewise, workmen who use their muscles after the manner of athletes do not become herniated; but any group of men who use one set of muscles without commensurate development of others may become herniated. Asymmetry of development is, then, an element of importance.

We may interject here the statement that no adult has ever been spontaneously cured of a hernia; spontaneous cure may occur up to the tenth year, but after that period cure is by a process of cutting and sewing.

We may also say that repeated or intermittent intra-abdominal strain is capable of aggravating a hernia once formed; but we hasten to add that every hernia habitually and of itself increases in size. So when we are called upon to render an opinion as to the relation of injury to the onset or progress of an inguinal hernia, we must also bear in mind certain clinical facts of every-day experience; of these, the following may add to what has already been said:

(A) A large proportion of adults have hernia and know nothing about it. In the draft age alone, witness the number of substandard candidates. If our young men were herniated by the thousands, what of our men over thirty years of age?

(B) A fully developed hernia on one side and a partly developed hernia on the other side is more an anatomic defect than a traumatic effect.

(C) There is a family history in hernia that is often very surprising; it points to some transmitted strain of muscular deficiency as typical as a facial feature or birthmark.

(D) We have fractures of the pelvis, of the thighs, and all sorts of injuries in the inguinal region, but who ever saw or recorded a case in which a hernia was an accompaniment?

To sum up:

(1) No single or isolated act of violence causes hernia unless the overlying parts have been lacerated.

(2) No single act of violence aggravates a hernia unless *that violence* produced intra-abdominal pressure and immediate onset of symptoms.

(3) Repeated acts of violence capable of causing intra-abdominal pressure can produce a hernia and can act as an aggravating cause if the violence and the symptoms are adequate.

(4) External violence is only one of many factors in activating intra-abdominal pressure which is the essential causative element.

(5) Repeated "strain" of many sorts may be as contributory as some alleged traumatic strain; of these intrinsic causes may be mentioned coughing, sneezing, straining at stool, or in urinating; and pulling and pushing motions incidental to athletics or some form of sport.

The Hernia Operation. Bassini Modified Technic Followed. —*Steps:* (1) Incision from spine of pubis upward and outward 4 inches, a little vertical to Poupart's ligament. Deepen this until the shining strands of the external oblique fascia are seen; the latter is just below the areolar tissue layer.

(2) (*a*) Expose the external ring and contents.

(*b*) Expose a white band at the outer side of the fascia; this is the external aspect of the "shelving edge" of Poupart's ligament (*i. e.*, the latter is the twisted part of the external oblique fascia).

(3) Expose the canal by slitting the external oblique fascia and dissect it freely, especially the outer part, so that the inner side of "shelving edge" shows plainly.

(4) Lift up contents of canal by placing tip of index-finger around cord at pubic spine. Recognize vas by sight and by touch; it is as hard as metal and does not compress like a vein.

(5) Recognize sac at *internal* ring end and separate it from adjacent elements of cord.

(6) Bring neck of sac clearly into view by dissection and traction.

(7) Open sac and recognize the interior of it by the resem-

blance to the inside of a morning glory; this is a good test as between a real and a false sac.

(8) Transfix sac and cut off excess. Leave ligature long and drop sac stump, and then pull it into view again; this tests the hold of the ligature and the hemostasis.

(9) Keep cord out of the field by passing an artery clamp under it, catching the lower margin of the external oblique fascia in two places; this will hang the cord over the outer edge of the field.

(10) With chromic or kangaroo tendon gut narrow the internal ring with a stitch joining the internal oblique and the "shelving edge." Leave just room enough for the cord to snugly fit. Cut this ligature long and clamp it; by pulling on this the next suture can be readily passed through the same structures ½ inch further along. Each succeeding interrupted suture is clamped in turn. Narrow the external ring in the same close-up manner as the internal ring.

(11) Drop the cord into place. With continuous chromic or kangaroo tendon gut, suture the fascia.

(12) With plain gut, continuously suture the deep layers of the superficial fascia.

(13) Close skin and superficial fascia.

(14) Evert margin of wound and forcibly eject any blood so that the wound layers will be dry.

(15) Make a ridge of gauze along wound and then place on this the usual compresses and adhesive.

Postoperative Course.—(1) Suspensory, or adhesive bridge over thighs to support scrotum.

(2) Morphin per hypo. (gr. $\frac{1}{6}$ followed by gr. $\frac{1}{8}$) for severe pain only.

(3) Catheterize for first twenty-four hours, p. r. n. Thereafter do not catheterize, but allow patient to get out of bed, bend forward, and thus spontaneously void.

NOTE.—This is done in preference to inducing a cystitis which may develop from the trauma of aseptic catheterization. It does not strain the wound if the patient relaxes by bending forward.

(4) Stitches out on tenth day.

(5) Out of bed on the twelfth day.

(6) Out of hospital on the fourteenth day.

(7) To work on the twenty-eighth day if the parts are firm. Patient cautioned against intra-abdominal strain for six weeks. No bandage or other support to be used.

Comment.—Success in obtaining a cure depends primarily on the following factors:

(1) Ability to obtain a high tie-off and narrowing of the neck of the sac. If this is attained, the pre-existing diverticulum of the peritoneum is definitely abolished.

(2) Ability to firmly coapt muscle (internal oblique and conjoined) to the "shelving edge." If this is attained an effective barrier is built up against further intra-abdominal strain and subsequent direct hernia.

(3) Ability to lengthen the distance between the rings by transplantation of the cord. If this is attained, any hernia seeking escape at the rings will find the exits blocked by a layer of muscle and fascia instead of by tissues far less resistant.

(4) Ability to obtain primary union. If this is attained, all newly joined barriers offer lasting stability.

Recurrence.—Statistics vary as to the success of operation, but the rate usually quoted varies between 2 and 5 per cent. All surgeons know that a recurrence rate in direct hernia is about twice that of oblique hernia. Equally well known is the fact that in persons over forty-five the rate of recurrence varies from that in persons under forty-five. In working people the rate is greater than in the non-working class. In the fat, the thin, the enteroptotic, the diseased, the arteriosclerotic the rate varies in hernia end-results just as it varies in many other surgical end-results.

Our own rate of recurrence in working males is between 5 and 10 per cent.; in the non-workers the rate is less than half of this. Hence the clinical fact is that (*a*) the physique, (*b*) the type of the hernia (direct or indirect), and (*c*) the occupation determine the end-results quite as much as the (*d*) operation elements named above.

TRAUMATIC SPONDYLITIS (KUMMEL'S DISEASE)

S. G., aged twenty-nine, a telephone lineman by occupation.

Past History.—Negative for syphilis or tuberculosis.

Present History.—Seven months ago he fell from a tree, a distance of about twenty-five feet, and landed on his back. Unconscious for several moments. Did not vomit. Could not use right lower extremity, nor when pins were stuck in it had he any sensation. Bladder overflowed spontaneously. Had no knowledge as to action of bowels.

After nine weeks the lost sensation and motion of right lower limb disappeared. Bowel function restored. Urinary control still involuntary, so that dribbling is marked enough to keep clothing soiled. When he got out of bed at the end of about ten weeks he noticed that his back was arched forward and that there was a lump on it. The arching and the lump have slowly increased. Treatment at first was rest in bed, and later massage was given. Previous *x*-ray examination is said to have disclosed no fracture of the spine.

Patient now complains of:

(1) Inability to walk erect; (2) pain radiating from the back around the abdomen and along the groin, more marked on the right side; (3) inability to control urine; (4) limitation of motion in the right lower limb.

Examination shows good general physique.

Back.—Kyphos over the second lumbar region. Slight scoliosis. Marked forward arching of the spine. All spinous processes can be located.

Limbs.—No motor or sensory paralysis. Limitation of right hip motion in full extension and abduction.

Reflexes.—No gross changes. Clothing soiled by involuntary urination.

Gait.—Limited. Walks bent forward and to the right.

Diagnosis.—Fracture of lumbar spine—traumatic spondylitis.

x-Ray Diagnosis.—Fracture of lumbar spine with marked thinning of anterior portion of vertebral body.

Treatment.—Plaster-of-Paris jacket with spine previously straightened as far as possible. Immediate relief considerable.

Comment.—Here is a patient who originally had a combined intra- and extraspinal lesion; the former probably a contusion of the cord with hemorrhage; the latter a fracture of the body or bodies of the vertebra. In other words, this is a case of fracture of the spine with hematomyelia in which the end-result is deformation of the bony column and some paralysis of the bladder.

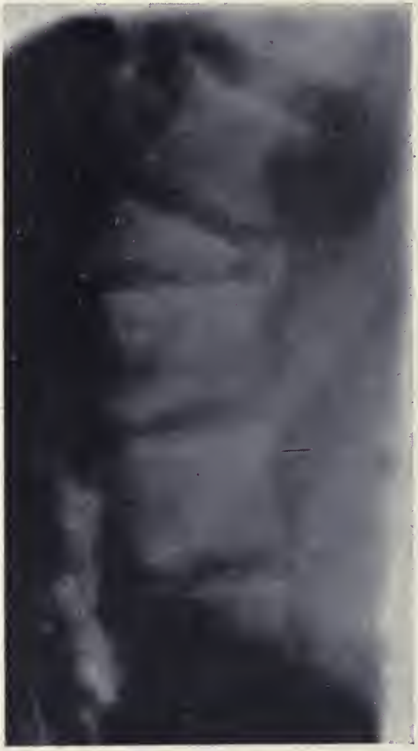

Fig. 687.—Traumatic spondylitis, showing typical V-shaped deformity of vertebra with kyphos.

We have had 4 cases of this sort recently, all of them involving the dorsolumbar region.

The outstanding features in all the cases have been:

(1) History of an injury to the back without early gross evidence of spinal column damage.

(2) Intraspinal symptoms varying from root pains to paralyses (motor, sensory, trophic, or visceral).

(3) Persistent localized pain over the affected vertebræ and limited motion of the spinal column with gait defects.

(4) Gradual appearance of a lump in the painful area of the spine.

(5) Increasing difficulty in arching of the back.

(6) *x*-Ray appearance of the vertebra, so that the normal U shape of the body is converted into a V shape, the thin edge forward.

(7) Motor, sensory, trophic, or visceral impairment of varied extent.

Diagnosis.—Given a history of definite injury to the spinal column capable of producing a fracture of the spine, with or without appropriate cord symptoms, and the presence of localized tenderness of the column and the subsequent development of kyphos, the diagnosis should be entertained of fracture of the spine affecting primarily the anterior portion of the column, even though the original *x*-ray examination fails to disclose definite bony damage. Differential diagnosis is to be made between hematomyelia, contusion of the spine, traumatic lumbago, sacro-iliac sprain, or damage to the intraspinal ligaments.

Military experience has shown several cases of so-called traumatic bent back, which goes by the name of "camptocormia," which has the forward arching of the column, the bent back, and the root pains seen in traumatic spondylitis. There are, however, no bony changes on physical or *x*-ray examination.

Traumatic spondylitis with V-shaped deformation of the affected body of the vertebra is to trauma what the similar deformation is to tubercular spondylitis (Pott's disease), and the *x*-ray findings are strikingly similar in each, inasmuch as the vertebral bodies undergo a similar grade of rarefaction.

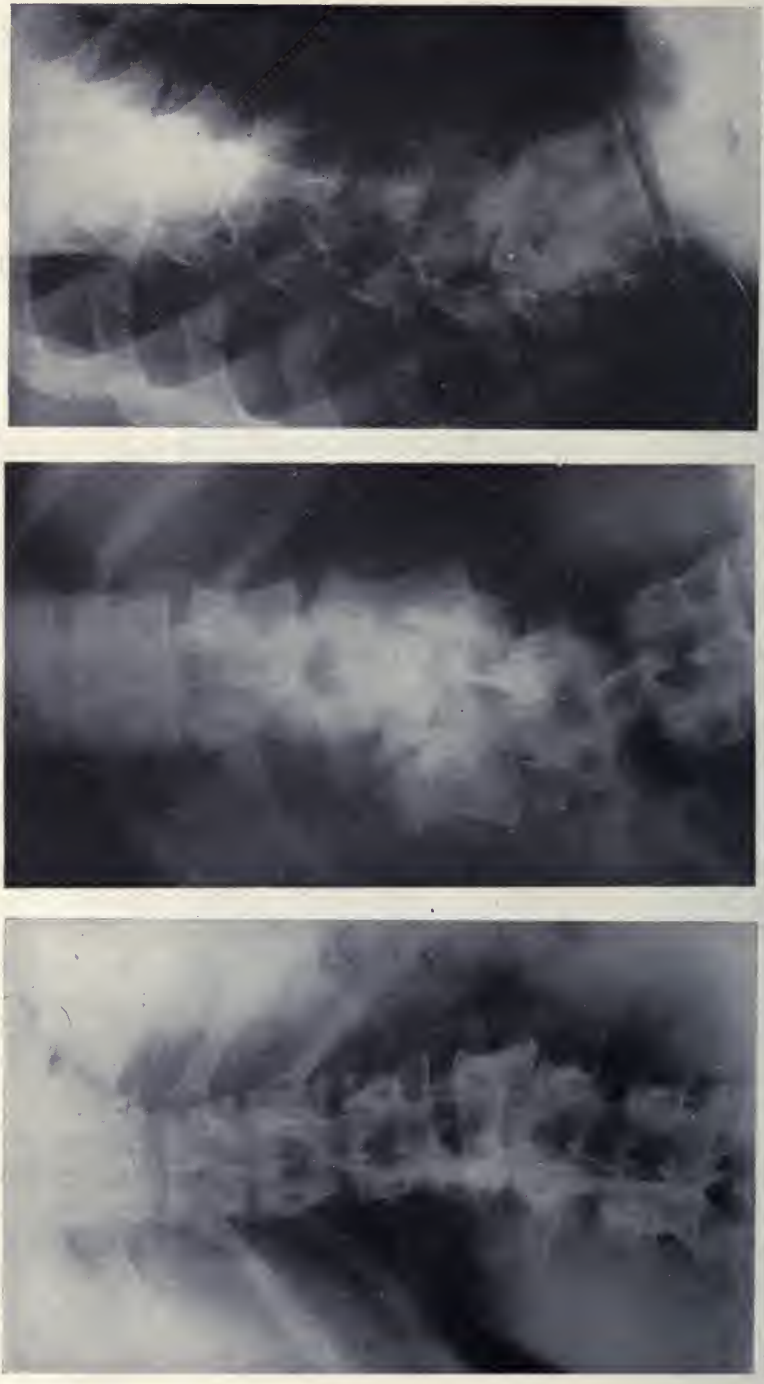

Fig. 688.—Fracture-dislocation of lumbar spine with subsequent spondylitis deformity. Note compression of anterior portion of vertebra.

Treatment.—In a suspected case of injury to the vertebral body immobilization should be provided from the outset, and this is best attained by a spinal jacket, as nearly all of the reported cases affect the dorsolumbar region.

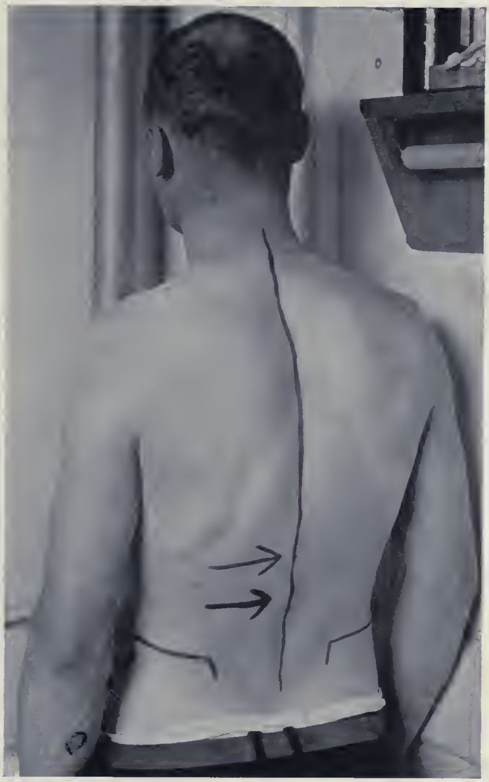

Fig. 689.—Traumatic spondylitis following fracture of body of vertebra. See *x*-ray plate in Fig. 687. Note kyphos at arrows.

In a doubtful case a spinal brace or plaster-of-Paris jacket should be applied with the spine in a corrected position to remedy so far as possible the kyphos and the associated scoliosis.

If despite the wearing of some such support the angulation still persists, it then becomes necessary to fix the spinal column by a bone-graft after the manner devised by Albee or Hibbs.

Scherb (Schweizer, Medizin. Woch., Basel, August 18, 1921, 51, No. 33) has described a modification of this spinal fixation graft by which the graft is laid alongside of the spinous process and held in place by tendon sutures.

Kleinberg, of New York City, has told me that he has successfully used this procedure for tuberculous spondylitis, employing beef bone-grafts instead of autogenous grafts.

The writer intends to attempt this operation in 1 of the 4 cases of traumatic spondylitis recently under his care.

MULTIPLE FRACTURES OF THE LEFT UPPER EXTREMITIES AND SHOULDER GIRDLE

T. O., aged thirty-two, a police sergeant.

History.—November 8th, while on a rapidly moving motor cycle, he crashed into a lamp-post in Central Park and was rendered temporarily unconscious. Bone is said to have been found sticking out of a laceration in the left armpit. First aid was rendered at another hospital for this wound, a scalp wound, and a fracture of the left humerus in two levels.

Operation at the Post-graduate Hospital four hours after injury.

Findings—Procedure.—Lacerated wound 2 inches long in the left frontal region previously sutured; re-iodinized and a sterilized small rubber drain inserted. There was a comminuted fracture of the left humerus in the area indicated by the accompanying *x*-ray prints; also a fracture of the left radius at the upper third. There was a fracture of the left scapula spreading through the glenoid fossa, splitting the spinous process and the body of this bone. There was a gaping 2-inch wound in the left axillary fold. The margins of this were excised together with the frayed fascia beneath, and the cavity was found to enter the axillary space and spread along the pectoral fold. All devitalized tissue and blood-clot were removed, following the war technic first advocated by the French (who used for this technic the terms *débridement*, *épluchage*, *hemostase*, meaning by these that all devitalized tissue was removed by knife or scissors). Hence the frayed edges were smoothly clipped off and the wound left relatively dry. Tincture of iodin was swabbed freely about the cavity; interrupted stitches of silkworm-gut closed the wound and a small rubber tube was inserted into its depth. Wet dressing of iodin-water (tincture of iodin 1 dram and saline solution 1 pint) was placed over the wound. Traction was then made upon the abducted arm with the elbow at a right angle and a plaster-of-Paris spica was applied, reaching from the nipple line up to the neck, across the shoulder, and thence down the arm and forearm to the wrist, the elbow being held at a right angle and the forearm in semisupination—the abduction spica dressing.

Comment.—Tetanus antitoxin was administered prior to the operation because of the chances of soil infection, and this is a precaution that should not be neglected in any compound fracture, or, indeed, in any wound in which manured soil has an opportunity for contact. All fractures of the humerus in which there is displacement of the fragments lend themselves to two methods of treatment after the fragments have been coapted by

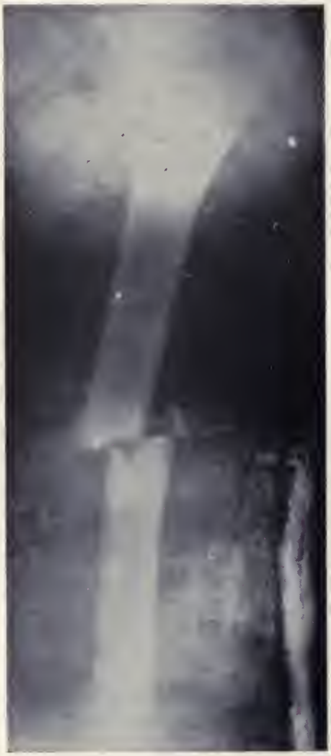

Fig. 690.—Compound fracture of upper third of humerus before reduction.

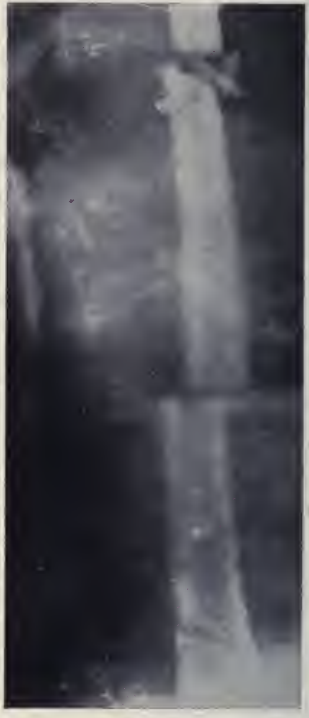

Fig. 691.—Fracture lines in humerus after reduction.

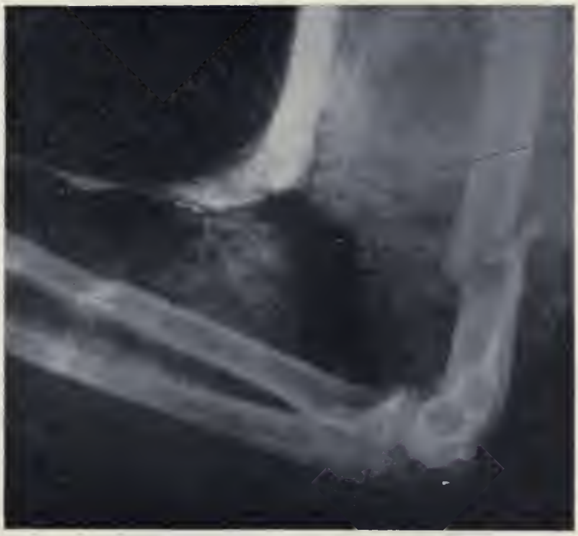

Fig. 692.—Fracture of lower third of humerus and middle third of radius. Abduction molded splint applied.

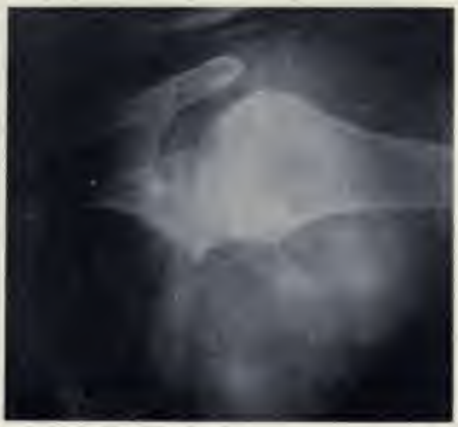

Fig. 693.—Fracture lines in scapula radiating from glenoid into body and spinous process.

traction or manipulation. The fractures of the *lower* fourth of the humerus, namely, those involving the supracondylar and condylar region, are to be placed in a position of hyperflexion

(Jones' position), and the forearm is to be in a position of marked abduction so that the normal carrying angle will be maintained. Fractures of the *upper* three-quarters of the bone are best treated in a position of abduction of the arm to a right angle with the forearm carried in a position of semisupination forward of the axillary line, the elbow bent at a right angle and held by a plaster-of-Paris spica, thus attaining the aëroplane position.

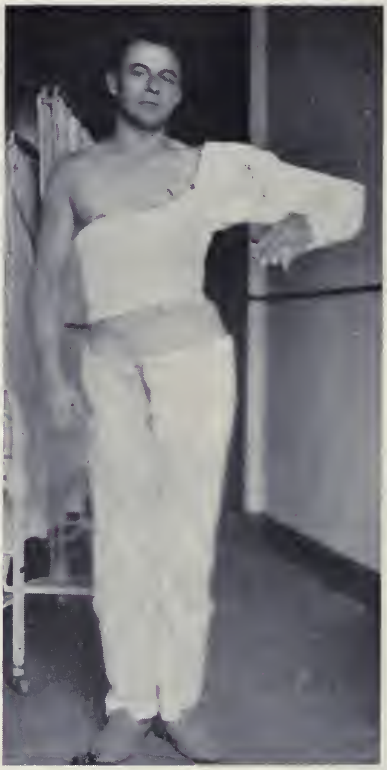

Fig. 694.—Abduction plaster-of-Paris spica for multiple fractures of upper extremity.

This patient had practically no postoperative reaction, and the drain was removed on the third day by cutting a window in the cast over the site of the wound. The patient was then allowed out of bed in a chair.

The accompanying *x*-ray prints show the success of the reduction. The cast will be slit along the top of the extremity in about six weeks, and the cast will be removed and the arm brought to the side if union is firm; otherwise the same cast will be reapplied.

Outlook.—The general alignment is excellent and bony union should be attained in the humerus unless the small fragments noted act as foreign bodies, in effect blocking the passage of bone-cells between the ends. In this event no union will occur. Coaptation of the radius seems sufficiently good to attain union. Non-union in fractures is most likely in the lower third of the tibia, and in the experience of the writer more cases of non-union occur in this location than in all the other parts of the skeleton combined. Non-union is next commonest in the radius, then ulna, then humerus, and then femur. The writer has never seen a case of non-union in the fibula even when the fragments have been much malaligned. There is practically no such thing as non-union in joint fractures except in fractures of the neck of the femur.

The commonest cause of non-union is non-reduction; the next commonest is non-retention either by too tight or too loose splintage. Interposition of soft parts (fascia, muscle, periosteum) or hard parts (bone, cartilage, or foreign bodies) are the next commonest causes of non-union. Systemic diseases are rare causes, notably syphilis. Calcium deficiency is a not uncommon cause. The use of plates, screws, wire, or any other form of non-absorbable material invites non-union, and virtually introduces into the tissue a foreign body which is not well tolerated. The writer is of the opinion that plating and allied methods in fracture work is being rapidly abandoned, just as the use of metallic sutures has long ago been abandoned for coaptation of the soft parts.

REVISION OF LAMINECTOMY FOR FRACTURED SPINE

History.—M. G. H., aged thirty-seven, manager of electric company. December 1, 1918 was struck on the back by a heavy valve stem, which resulted in a fracture of the twelfth dorsal vertebra and a puncture of the left lung. There was immediate motor and sensory paralysis from the waist down, including loss of bladder and bowel control.

Operation the same night, when splintered bone and clothing are said to have been removed from the spinal canal. Five weeks later paralysis had descended to the level of the iliac crests. Spasticity of the legs after two months. Good union of the primary wound. Paralysis continued unchanged until the time of the second operation—March 1, 1920.

Laminectomy was then performed in the dorsolumbar region with removal of the scar tissue. After this operation sensation was present in thighs, and there was less rigidity of the limbs; but this gain disappeared after a few months.

Since then he has been at home and there rigged up for himself an overhead trolley arrangement with ropes by which he could get about his room.

Bowels moved daily by large enemata, and he constantly wore a urinal.

He entered the Post-graduate Hospital eight weeks ago, and at that time his general physique was excellent. There were no bed-sores, and the only obvious injury to the spinal column was at the site of the operative scar, where three of the spinous processes were lacking (twelfth dorsal, first and second lumbar). There was complete motor and sensory paralysis from the level of the anterior-superior spine downward. Both lower extremities were rigidly spastic. All reflexes were abnormal. Bowel and bladder control were as described.

Under active massage and forced movements of both limbs the spasticity lessened. He was up and about daily in an invalid walker. Large enemata on alternate days for the bowel condition, and the urinal was worn constantly.

x-Ray examination showed the absence of that portion of the spinal column already described. There was no gross angulation of the spinal column, nor were the bodies of the vertebræ unduly compressed.

Comment.—Here is a case of massive injury to the spinal cord with abolition of all function from the level of the injury downward. Primary operation evidently removed spiculæ of bone only, and a second operation evidently freed the cord, at least the posterior portion, as indicated by the return of sensation. His condition has been unimproved for about a year and a half, and operation was decided upon in the hope that one of the following remediable conditions might be found:

(1) Angulation of the cord by bone or scar.

(2) Localized serous collection, the so-called posttraumatic spinal cyst named by the late Munro "localized serous meningitis."

(3) Intradural or extradural adhesions, or both.

Finally, it was recognized that under existing conditions further progress could not be obtained after this lapse of time. This situation was explained to the patient and family, and, while the outlook was not good, the operation was assented to.

Operation (November 10, 1921).—*Steps.*—(1) Curved incision to the right of the original incision, extending from the eighth dorsal to the second lumbar level.

(2) Scar tissue incised and retracted. Sharp hemorrhage controlled by packing, and wide retraction by rib-spreaders.

(3) Cord was exposed for a distance of 4 inches by removal of a portion of the remaining arches. Dural membranes found much thickened and tightly adherent laterally and anteriorly.

(4) Extradural adhesions separated by sharp dissection.

(5) Dura split, followed by an immediate gush of somewhat turbid, then by clear, cerebrospinal fluid under pressure. No severance of the cord apparent. Probe readily passed up and down the canal for a distance of 2 inches each way.

(6) Dura sutured so that cerebrospinal fluid escape almost

stopped. Erector spinæ and scar tissue firmly closed by interrupted chromic gut sutures.

(7) Deep fascia closed by running lock-stitch chromic gut.

(8) Silkworm-gut interrupted stitches for skin and fascia.

(9) Wound squeezed dry.

(10) Heavy dressing of gauze moistened with iodin-water (1 dram of tincture of iodin to 1 pint of saline solution).

(11) Heavy strapping of adhesive plaster.

Postoperative Orders.—(1) Morphin ($\frac{1}{6}$ gr.) followed by morphin ($\frac{1}{8}$ gr.) hypodermically for severe pain.

(2) Dorsal position. Head of bed elevated.

Summary of Operative Findings.—(1) Extradural and intradural adhesions.

(2) Narrowing of the canal by bony re-formation or non-removal.

Outlook.—Barring ordinary postoperative complications, such as pneumonia and that form of sudden collapse incident to spinal cord operation, there should be an immediate postoperative recovery with primary union. Ultimate gain will probably take the form of sensory return to some extent with little prospect of motor or visceral return. In other words, the relief from his present condition of paraplegia is very doubtful.

Spinal cord regeneration following actual damage to the cord structure is rare, and there are only a few cases on record where functional restoration has been obtained in the presence of structural damage. The spinal cord structures have no powers of regeneration, and military experience has proved over and over again the truth of this long-established clinical fact.

It is equally well known, however, that in the absence of operation the outlook is hopeless; nevertheless, in a case of this gravity and long duration, operation offers the only possible chance for relief from prolonged invalidism.

The one outstanding case in the author's experience of recovery following definite structural damage is recorded in the writer's Traumatic Surgery, 2d ed., pp. 602, 603, in a young girl under the care of Dr. Irving S. Haynes and the writer. This patient is now able to earn her living, and some slight gait defect is the only remnant of her bullet wound penetrating the cord and liver.

Note.—December 6th: Patient apparently much improved. Spasticity decreased; joint freedom more marked. Is able to correctly interpret when deep pressure is made on legs. Wound healed kindly. Being fitted for double walking calipers.

KNEE-JOINT INJURIES

TRAUMATISM to joints usually expresses itself in terms of contusions, sprains, ligamentous tears, bursitis, synovitis, tenosynovitis, arthritis, dislocations, fractures; in abridged form we can say that joint injury may be intra-articular or extra-articular, may involve the soft part or the bony structure of any given articulation. In the knee-joint we have the complexities inherent to a double joint, the pathology that may appear from damage to such structures as the semilunar cartilages, their contiguous crucial ligaments and the tibial spine. The generous synovial membrane with many pouches, the numerous bursæ, also contribute to make this joint the site of every manifestation to which articular pathology has given a nomenclature. There is no other joint of similar architecture, none in which diagnostic skill is more severely put to test, none in which adequate treatment is more important.

Frequency.—Wounds excepted, contusions or contusion-sprains are the commonest injuries; next, synovitis, bursitis. As antecedents, associates, complications or sequelæ, loose bodies or crucial ligament tears are next in frequency; still later are such bony injuries as fracture of the patella, the margins of the femur or tibia. Least frequent are fractures of the tibial spine, and uncomplicated dislocations of this joint.

Except for incidental remark no discussion is here intended for knee lesions other than synovitis, loose bodies, semilunar, crucial ligament, and tibial spine affections. These are very closely interrelated as to causation and effect, inasmuch as all of the so-called "internal derangements" of the knee are aligned with synovitis; indeed, many loose bodies originate from synovial trauma.

Structure.—The articulation between the femur and tibia needs no special description except to say that the inner margin of each bone because of prominence and contour is predisposed to damage; this is accentuated because the vertical axis of the thigh to the leg is one of abduction at an angle of 165 degrees, and the preservation of this makes greater demand on the inner than on the outer side of the joint. There are twelve *bursæ* connected with this articulation: three in front, four on the outer side, five on the inner. Of these, the prepatellar bursa attracts most attention surgically.

There are three main *synovial pouches* or sacs, all intercommunicating when the joint is distended. Of these, the largest is the superior or *suprapatella*, which is on the femur above the patella. The second is the *central* or *middle* pouch which has for its boundaries the patella above and the mucosum and alar ligaments below, all tending to form a diaphragm from the front to the back of the joint. The third is the *posterior* or *inferior*, which lies behind the preceding diaphragm and between it and the posterior ligament of the knee-joint. This last pouch or cavity is most important in septic conditions because it acts as a reservoir for pus and cannot be emptied by aspiration. When this sac is involved, the best clinical sign is fulness of the popliteal space and from it fluid may insidiously gravitate along the posterior surface of the limb until released by incision directly into or below the popliteal space.

With the five sets of so-called "exterior ligaments" and the seven sets of so-called "interior ligaments" we are interested chiefly by the latter consisting of the crucials, the semilunar fibrocartilages; the mucosum, the alar, the transverse, and the coronary ligaments are appendages respectively of the main synovial cavity and of the capsular ligament.

Crucial ligaments are so-called because they cross or decussate X-like en route from the tibial head to the femoral condyles.

The *anterior* or *external crucial* is surgically the most important, and is attached to the depression in front of the tibial spine and the front end of the external semilunar, and thence it passes to the inner and back part of the outer condyle of the femur.

The *posterior* or *internal crucial* is the stronger, shorter, and more vertical, and is attached to the depression behind the spine of the tibia, to the popliteal notch, and to the posterior end of the external semilunar; thence it passes to the front part of the inner condyle of the femur. In passing it sends a fascial band to the posterior part of the anterior crucial.

This architectural arrangement readily gives the posterior crucial many advantages, which, being interpreted clinically, means that it is rarely injured except when its companion has first been damaged.

The chief function of the crucial ligaments is to keep the tibia from sliding too far forward or backward on the femur; the anterior crucials prevent the tibia from being carried too far forward by the extensor muscles, and the posterior crucials exert a restraining influence on the flexor muscles in carrying the tibia backward. They also aid the lateral ligaments in preventing undue side-to-side motion.

In full knee flexion the posterior crucials are taut and so is the ligamentum patellæ; all the others are relaxed by this motion, the anterior crucials only to a slight extent, however.

In full knee extension the ligamentum patellæ is relaxed; all the others are on stretch except the posterior crucial, which is partly relaxed.

In a position of semiflexion, rotatory motion is permitted by partial relaxation of the crucial and lateral ligaments.

Inward rotation is limited by tension of the anterior crucials and by the interlocking of both crucials.

Outward rotation is limited mainly by the internal lateral ligaments; the crucials unlock and relax in this movement.

All this is usually summed up by saying that the anterior crucials are taut in extension and the posterior crucials are taut in flexion. Some believe that they are each taut in full flexion and extension and both lax in semiflexion.

The *semilunar fibrocartilages* are the intervertebral disks of the knee-joint, shock-absorbers, serving also to deepen the pockets on top of the tibia so that about two-thirds of the surface into which the femoral condyles socket has this sort of "bushing," which is synovia covered.

The *internal semilunar* is almost semicircular, and is attached in front by a thin pointed margin to a depression on the head of the tibia just in front of the anterior crucial ligament; and behind to a depression back of the tibial spine between the attachment of the external semilunar and the posterior crucial ligaments.

The *external semilunar* is almost circular, is larger than the internal, and has a groove on the outer side for the popliteus muscle. The anterior end is attached to the front of the tibial spine behind the anterior crucial ligament, with which it blends; the posterior end is fastened behind the tibial spine in front of the rear attachment of the internal semilunar, and just before this it gives off a strong fasciculus to be attached to the inner condyle of the femur close to the attachment of the posterior crucial ligament. In front it gives off another fasciculus known as the transverse ligament.

This architecture makes the anterior or external crucial ligament more vulnerable than the posterior or internal crucial because it is the weaker, longer, more oblique, and it has fewer accessory supports. Likewise, the internal semilunar cartilage is more vulnerable than the external because the latter is larger, more nearly circular, it is grooved for a muscle, the attachments front and rear are better protected, and it also has two fasciculi which are virtually ligamentous anchorages. It would appear as if additional natural defenses were purposely designed for the external margin of the knee to compensate for the absence of any articulating bony support. In this respect, as in many others, the structure of the elbow-joint is imitated. We know clinically that violence sustained by the elbow registers most often upon the inner margin of this articulation, just as in the knee-joint. A similar parallel exists when we compare the wrist- and ankle-joints, as in each of these the outer margin is more often injured than the inner; Colles' fracture and Pott's fracture are manifestations of this selective action, lesions of the outer bone in each instance being the cardinal pathologic factor.

Clinically we are interested in knee pathology connected with: (1) Synovia, (2) crucial ligaments, (3) semilunar cartilages, (4) tibial spine or their sequelæ, (5) loose bodies.

Synovitis arising from trauma, infection, or disease is chiefly characterized by a swollen knee in which lateral motion is increased. In traumatic cases we frequently have a history indicating preceding attacks; in such instances and in those in which direct violence can be excluded we must be prepared to rule out loose bodies as the real causative factor. Careful examination may give palpatory evidences of such an offender; if not, injection of the joint with oxygen may serve to make known what an ordinary *x*-ray plate would fail to detect.

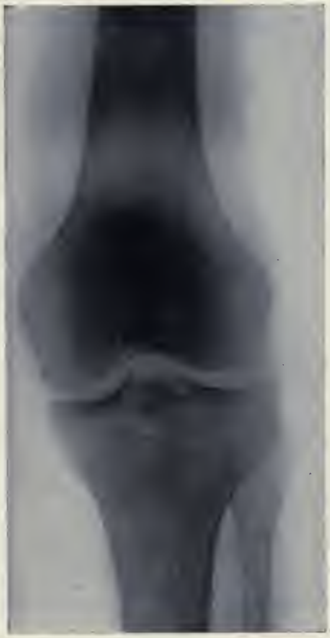
Fig. 695.—Normal knee-joint.

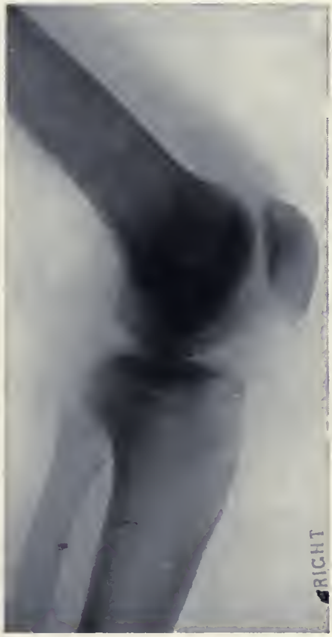

Fig. 696.—Normal knee-joint.

Oxygen injection of the joint is best performed by introducing the needle just outside the external margin of the patella just above the middle of this bone, so that the point of the needle passes beneath the outer margin of the patella somewhat downward and inward. We must remember that with the knee in extension the joint level is lower than the tip of the patella.

Preliminary freezing with ethyl chlorid makes the introduction relatively painless, and, needless to say, aseptic precautions must be absolute. The caliber of the needle need not be larger than the diameter of the lead in an ordinary pencil. Enough oxygen is slowly introduced to completely and uniformly distend the joint, and the radiograms should be made within an hour, otherwise full inflation will not persist. After the needle is withdrawn the puncture site is covered by cotton and collodion, or a patch of sterile adhesive plaster. Radiograms should be made in four directions, namely, from before backward and the reverse, and from within out and the reverse. If any fluid is present in the joint it should be removed before introducing the oxygen. Carbon dioxid may be injected instead of oxygen.

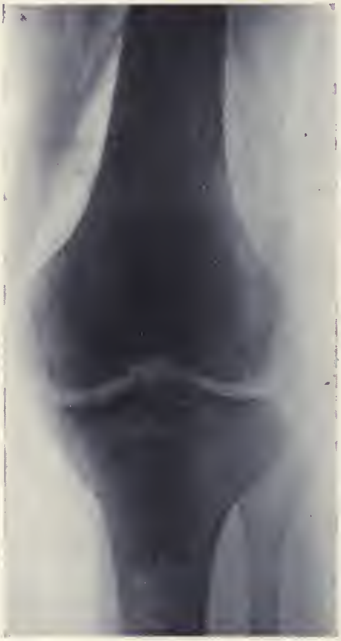

Fig. 697.—Oxygen-injected knee-joint.

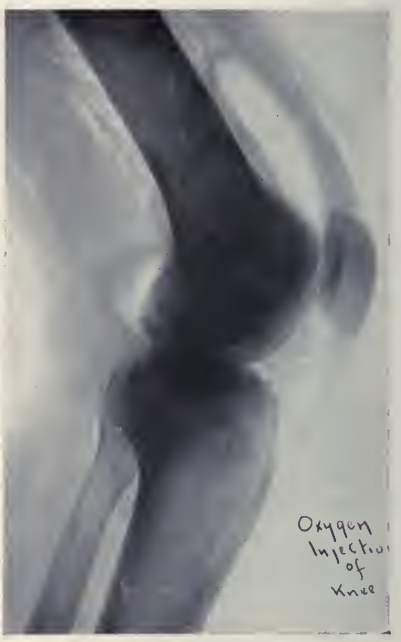

Fig. 698.—Oxygen-injected knee-joint.

Treatment of traumatic synovitis is most effective by the method of *immediate* aspiration and *immediate* mobilization of the joint. By contrast with the older method of continuous pressure and rest in extension, this newer procedure has the advantage of speed with certainty; it limits the possibility of stretching the synovial capsule and the parts contiguous; it prevents in a large measure organized exudate which is a very potential source of loose bodies, a great cause of re-effusion; it provides a means for bacteriologic study of the exudate. Given a case of acute or chronic traumatic synovitis, the procedure is to aspirate the joint at the site and in the manner above indicated for oxygen injection. All the fluid is aspirated and the removal is made the more complete by massaging the joint contents toward the needle. Occasionally a blood-vessel may be punctured, but this does not modify the procedure, nor does the presence of blood within the joint itself. After the needle is withdrawn the patient is made to move the joint by his own volition to a right angle if this is possible; thereafter, every two hours, voluntary or active motion of the joint is insisted upon, and no dressings of any sort should be applied to interfere with this. If the patient is seen within a few hours of the injury the best procedure after aspiration is to make the patient walk and use the knee in as nearly a normal manner as possible. These early cases need not be kept in bed at all, for overactivity of the joint will become manifest by pain, heat, and swelling; but the appearance of these must not interefere with the active mobilization. Re-effusion usually occurs after the first day; if it does not recede within the following twenty-four hours, re-aspiration should be performed in the same manner in the same zone, but not through the same opening. It is very rarely necessary to aspirate more than twice.

Subacute or chronic traumatic synovitis is treated in the same manner; but in these, atrophy of the contiguous muscles will require massage and the joint will be stretched enough to require the support of a linen-mesh or other bandage. It is this group and the recurrent forms in which *x*-ray examination of the air-injected joint will prove especially valuable in excluding loose bodies or other sources of intra-articular irritation.

Synovitis arising from distant or systemic sources of infection does not come within the scope of these remarks, nor are we here concerned with tubercular, syphilitic, or neurologic sources of origin. In passing, it may be stated that syphilis must be suspected in any case of painless massive synovitis that occurs without adequate trauma. *Any synovitis that recurs after repeated aspirations and active mobilization is not ordinary uncomplicated synovitis, and a constitutional source should be sought if an intra-articular irritant can be excluded.*

Purulent synovitis or joint empyema due to wounds or metastases may be said to appear in three types: (*a*) Mild; (*b*) moderate; (*c*) severe.

(*a*) Mild types are treated by repeated aspirations and mobilization. The injection of 2 to 4 drams of ether after each aspiration will be of decided benefit. I have used ether injections in war wounds with great satisfaction since the method was called to my notice by Major Lardenois, then Consultant of the Fifth French Army Corps with which I was serving.

(*b*) Moderate types are treated by a vertical unilateral or bilateral incision parallel with the other border of, or just lateral to, the margins of the patella. Each incision is to be at least 2 inches long, the fluid within the joint is forced out by joint motion or irrigated out with ether, and thereafter the patient is made to move the joint himself each two hours (day and night), so that the joint contents are literally squirted out each time the articulation is bent or straightened. No encircling dressing must interfere with joint action; as a matter of fact, no dressing need be used except when the patient is asleep. No irrigation of any sort is permissible except ether, and this is used mainly because it leaves no residue after evaporation. No drainage-tubing or any other material enters the joint—drainage is entirely by the to-and-fro motion of the joint, which overcomes seepage, prevents pocketing, promotes absorption, limits atrophy, inhibits adhesions.

(*c*) *Severe types* are treated by vertically splitting the patella after the manner described below (Jones' operation). This permits a very wide exposure of the joint so that all portions of it are freely visible. Irrigation by ether rids the cavity of all secretion, and the joint is then supported on a pillow with the knee at or near a right angle so that the margins of the patella are separated at least 1 inch. Each two hours the joint is fully bent and fully extended, the secretion being squeezed out during this motion. In certain cases it is advisable to allow the injured and the uninjured leg to dangle from the edge of the bed so that the knee is better kept at or near a right angle. If this is done, there will be less tendency for seepage into the popliteal space, and in every case the rear of the joint must be carefully examined to prevent insidious progression along the back of the limb. This patella-split procedure will give as good spontaneous drainage as the procedure of cutting the patella tendon and lifting back the patella (the Mayo operation). It is far less disabling also, for my experience with this last-named procedure is that the joint can never again become properly socketed, the leg always receding, joint motion becoming practically abolished.

These are, of course, desperate cases, and any procedure short of amputation is all gain to the patient. In many of these cases general sepsis is of such a grade that spontaneous motion of the joint is beyond the strength of the patient and passive motions may be too painful. In such an event the intermittent irrigation of the cavity every two hours should be practised, but in the interval no drainage-tubing or material should be introduced. The irrigating solution may be ether, iodin solution, saline solution, Dakin's solution, permanganate solution, or any antiseptic of choice. Needless to say, the general state of the patient should be safeguarded, notably as to relief from pain and a plentiful diet. These patients do very much better out of doors if the climatic conditions permit. No dressings of any sort should be applied because these virtually become pus poultices. It occurs to me that trephining the patella may prove efficient in a certain group in which the patella-split operation may prove too formidable.

Crucial ligament injury is not diagnosed as often as the occurrence demands, and I feel sure that we all have classified many cases as partial dislocation, synovitis, tearing of the lateral ligaments (especially the internal), and semilunar cartilage involvement. The anterior crucial is much more often injured than the posterior; indeed, some authorities assert that injury to the posterior crucial is always preceded by injury to the anterior crucial. The tibial spine may be avulsed as a part of the ligamentous injury; but either may occur independently.

Causation.—Recalling that the anterior ligament is tense when the knee is extended and that it is attached to the front of the tibia and the back part of the external femoral condyle, we can see that internal rotation and abduction of the straight knee is the most probable causative factor. In other words, violent wrenching of the internally rotated or abducted knee may rupture the anterior crucial ligament. Very severe grades of violence are necessary to injure the posterior crucials, and, as stated, the injury is then usually of both crucials.

Symptoms.—A painful hemorrhagic synovitis is the main finding. Manipulation of the joint may show that the tibia can be displaced forward on the femur; if so, the diagnosis of lacerated anterior crucial ligament is resonably certain. If the reverse pertains (displacement backward of the tibia on the femur), the posterior crucial is involved. Excessive rotation (usually outward) of the tibia on the femur is an associated finding. The sound knee should be examined to ascertain the normal limits of motion because individuals vary in respect to physiologic knee motility.

If there is limitation to full extension, concurrent injury to the tibial spine must be regarded as probable.

The internal lateral ligament is usually more or less torn when the anterior crucial is involved.

Some authorities say that pain and disability in full extention is always present in anterior crucial injury, and similar signs on flexion indicate posterior crucial injury; but, manifestly, differentiation by such signs is unreliable.

The three cardinal signs are: (1) Synovitis; (2) excessive forward or backward motion of the tibia; (3) excessive rotation of the tibia, usually outward.

Treatment may be non-operative or operative. Non-operative treatment consists of aspiration of the bloody fluid, and posterior splintage for three to six weeks, gradual motion being permitted thereafter. Massage is given from the onset and the patient can be permitted to walk if the splint is adjusted to prevent flexion and rotation. The outcome under this form of treatment is not particularly certain because repair of a much torn ligament cannot be relied upon if coaptation is not provided. Another defect is the possibility of associated injury, notably of the tibial spine. Finally, it is known that all the blood cannot be aspirated from the joint, and thus fibrin may become deposited, leading to the formation of loose bodies. A "slipping knee" will be the outcome if ligamentous union is not firm.

Operative treatment designs to reef or anchor the torn ligament to the femoral condyle by means of absorbable or non-absorbable sutures (silk or linen). The exposure is best obtained by the patella-split operation described below. Two holes are bored in the condyle of the femur and the sutures are passed through these after piercing the ligament. Gradual motion can be permitted after two to four weeks. This method gives a complete exposure of the joint so that all fluid can be removed and any associated damage repaired.

Obviously, operation should be advised only for selected cases, and it is particularly indicated in the robust and in any case where doubt exists as to the actual extent of injury. If after a reasonable trial of non-operative measures slipping of the knee still persists, exploration is advisable as a substitute for apparatus. Robert Jones is rather inclined not to operate until conservative methods are tried for two to six months.

Semilunar cartilage injury is now demanding a larger share of attention because the diagnosis is being made more readily since we have learned that locking of the joint is not a necessary symptom. It is my opinion that during the war period more operations were performed for this condition by American surgeons than for the preceding two decades. In England this lesion has been diagnosticated with great frequency for many years; indeed, in certain parts of Great Britain where mining is active, semilunar involvement is almost an occupational disease.

I am convinced that in our country we have far more cases than we suspect, and we have masked or missed or massed the diagnosis as "recurrent synovitis," "rheumatism," "neuritis," "ruptured ligaments."

The internal semilunar cartilage, as stated, is much the more vulnerable for the reasons already given. It is involved from twelve to thirty times more frequently than the external, these extremes representing the statistics of various operators. The rugged, robust athlete or workman is the usual victim, and women are very rarely affected.

Causes.—The essential factor is strain imposed upon the knee at a time when the joint surfaces are not apposed. When the knee is in a position of extension the condyles of the femur contact with the semilunar cartilages, thus protecting them even from direct violence. However, when the joint assumes a position of flexion, this protection is withdrawn, the lateral and crucial ligaments are more or less in tension, and any torsion of the joint brings pressure to bear on the semilunars themselves or upon the soft parts contiguous to them. Hence, rotatory flexion of the joint with fixation of the leg or foot is the primary cause. Eversion of the leg is the common form of torsion and in this position greatest strain is thrown upon the inner side of the joint, and hence the inner more vulnerable internal cartilage is much more often affected. A direct blow on the flexed knee may produce less often the same effect. Thus a misstep, an incomplete or broken fall, a sliding, twisting motion of the joint, all these may dislodge a cartilage. A single act of violence may incompletely or completely dislodge a cartilage, and the effect may produce symptoms varying from sudden sharp pain with little or no disability to complete locking of the joint with excessive disability. I am of the opinion that the initial act of violence may fracture, dislocate, or dislodge a cartilage, and that another act of violence at a distant period may wholly detach a cartilage, perhaps even to the extent of making of it a loose body. It is unusual in my experience to find a distinctly loose or palpable cartilage as the end-result of one act of violence.

Symptoms.—These are proportionate to the extent of the injury, but in greater degree depend upon the prior history of the joint. Mild, moderate, and severe grades of cartilage injury have already been mentioned, and the symptoms correspondingly vary.

Mild grades are characterized by local severe pain accentuated by manipulation, temporary limp, and slight local effusion. After a few days, manipulation of the joint may be wholly painless. These are 1 plus (+) cases, in which a diagnosis of sprained knee is usually made.

Moderate grades give symptoms similar to the preceding, but the pain is greater, the disability is more prolonged, the effusion is more marked, and manipulation of the joint is painful enough to call our attention to one margin of the articulation. These are the 2 plus (+ +) cases, in which a diagnosis of lacerated ligaments or synovitis is usually made.

Severe grades are associated with very severe pain, the patient falls, the joint is locked, disability is prolonged, the synovitis is extensive, the tenderness over the cartilage persists a long time, and very rarely a loose body may be palpable after the swelling subsides. These are the 4 plus (+ + + +) cases, in which the correct diagnosis is frequently made; but in the absence of locking a diagnosis of synovitis is entertained.

Irrespective of the grade of injury we should be on guard in any case in which localized tenderness is apparent over a cartilage when the joint is manipulated and when direct pressure causes wincing. The occurrence of synovitis from *indirect* violence should also cause suspicion; indeed, we should become very chary of making a positive diagnosis of uncomplicated sprain of the knee.

In order of frequency knee-joint injuries may be said to consist of (1) Contusion-sprain; (2) synovitis; (3) lateral ligament injury; (4) cartilage injury—subluxation, luxation, fracture; (5) fractures; (6) crucial ligament injury; (7) tibial spine fractures.

One main differentiation of importance is between cartilage injury and crucial ligament injury. In cartilage injury local tenderness and limitation of full extension are signs of great value.

In crucial ligament injury rotation of the knee is increased and likewise forward and backward motion of the joint is relatively free. In recurrent cases, in the so-called slipping knee, the diagnosis generally rests between these two conditions.

The *x*-ray examination as ordinarily made is not of much value, but if the joint is injected with oxygen very much greater information will be obtained. The procedure has the added value of permitting aspiration of the fluid preliminary to the oxygen injection, and this is the most efficient treatment for the synovitis. In an ordinary *x*-ray examination negative findings with definite symptoms is suggestive of intra-articular loose bodies or cartilage injury.

Treatment.—*Non-operative.*—Minor grades require little if any attention. Strapping with adhesive will give a sense of security and aid in reducing effusion if any exists.

Moderate grades require treatment for the synovitis, and this is best accomplished by aspiration. When all the fluid is removed the joint should be loosely encased in a linen-mesh bandage and placed on a pillow in full extension. Each day the knee is slowly bent by the patient almost to a right angle, until by the end of a week full right-angled flexion is attained. Rotatory motions are restricted for several weeks. Then walking is permitted freely, the joint to be protected against sudden flexion and rotatory motions by a suitable support.

Severe grades are treated by unlocking the joint through the medium of strong flexion, traction on the bent leg, rotation toward the lesion, and extension. Anesthesia occasionally is needed for this. Effusion is aspirated. Rest in extension is provided as in the preceding variety. Walking is allowed when pain on pressure and motion subsides and some form of protection is provided.

Operative treatment will be advised only when the diagnosis is confirmed by physical examination, by the *x*-ray, or by the history of repeated attacks of pinching or slipping of the knee associated with local pain, effusion, or locking.

Recurrent attacks of synovitis, persistent joint weakness, a sense of joint insecurity, inability to perform certain motions without pain—these in combination justify operation, especially if the aspirated fluid is bloody.

The demonstrable presence of a loose body also justifies operation.

In a word, operation is advised for any healthy patient who repeatedly "wrenches the knee" during ordinary activities, and in whom each attack is associated with pain, effusion, and tenderness. This type of case justifies the term "irritable knee," and removal of the offender is as much indicated as in recurrent appendicitis.

Operation.—If the accused cartilage is definitely located a vertical 3-inch incision is made directly upon it, a hook is introduced, and all or part of the cartilage is removed. The knee is best explored when in a right-angled position, and hence at operation it may be allowed to dangle over the end of a table. Needless to say, every aseptic precaution must be taken, there must be no finger contacting with the wound, all sponges must be held by holders, all instruments must be handled by the operator alone, and immediately after use placed in a pan of boiling water, rinsed therein, and replaced on the tray by an assistant who uses clamps for this purpose. This is the so-called "hands off" or "don't touch" technic, and scrupulous employment of it will render this operation perfectly safe. After the cartilage is removed the deeper parts are closed in three separate layers. The first layer by interrupted plain catgut shutting off the capsule, the second layer by a similar stitch closing the deep fascia, the third layer closes the skin and superficial fascia by interrupted non-absorbable sutures (silk, linen, silkworm, horsehair). The sterile gauze and cotton dressing is so applied that knee motion will not be interfered with, and the patient is forced to move the joint by his own volition just as soon as the effects of the anesthesia have disappeared. Every day thereafter at regular intervals (each two to four hours) the joint is bent and straightened and after a few days walking is permitted. No splintage of any sort is allowable in this active mobilization procedure. If postoperative effusion is uncomfortable, the joint is aspirated after the plan indicated; this is repeated if necessary.

In three to four weeks the full use of the joint may be permitted without restraint.

When the diagnosis is not wholly clear the patella-split operation advocated by Robert Jones[1] will give better access. This is performed by hanging the knee over the end of the table and making a vertical incision from above the top of the patella to and beyond the lowest limit of the knee-cap. The edges of the skin are immediately protected by towels, and then the patella is bisected vertically by a metacarpal or other saw. The saw cut cannot be made wholly through the bone except with a rotary saw, but the section is readily completed with a few blows on a broad, thin woodcarver's chisel. The edges of the patella are now drawn apart by retractors, and if the entire joint interior is not thus exposed, the incision is enlarged upward through the quadriceps tendon, or downward through the patella tendon. Loose bodies, accessory fat pads, synovial fringes, or other intra-articular lesions are now fully exposed. The crucial ligaments, the tibial spine, and the semilunar cartilages are also brought into view. Before closure the joint should be flexed and extended several times so that any loose bodies hidden in the intracondyloid space may be dislodged. A few bleeding points at the upper and lower limits of the incision will require ligation, but, aside from these, bleeding is usually unimportant. Needless to say, all of the operation should be of the "fingers off" or "touch-me-not" technic, so that hand contacting will be eliminated. The interior of the joint should be bloodless and relatively dry before suturing begins. Closure is made by passing interrupted catgut sutures through the quadriceps tendon and then through the patella tendon, the knee being in extension when these are placed. The patella will be drawn into place by these, and now a continuous or interrupted series of catgut stitches will serve to unite the deep fascia. A final layer of interrupted non-absorbable stitches now unites the skin and superficial fascia. A light molded plaster-of-Paris or other splint is placed on the posterior surface reaching from the middle of the thigh to the middle of the leg. This splint is removed next day and the patient is made to move the knee as far as possible, the splint to be replaced thereafter. Each day this is repeated, and after the stitches are removed (about the seventh day) the splint is discarded and the patient is forced to move the joint many times daily. In selected cases I use no splint. Joint effusion that does not subside on the third day after the operation is removed by aspiration. Reaspiration may rarely become necessary. Walking should be encouraged after the splint is removed. If the joint becomes hot, swollen, or painful, a cold wet dressing of saline or boric solution will be effective unless infection has occurred. Joint reaction in the absence of infection usually means too active usage. At the end of the second or third week, and in some cases earlier, flexion of the knee to a right angle may be expected.

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[1] Brit. Jour. Surg., vol. 1, No. 1, p. 70, July, 1913.

Exposure of the joint through a unilateral or bilateral vertical incision at the margin of the patella gives such inadequate access that this procedure is wisely limited to well selected cases. The U-shaped incision cutting through the patella tendon is needlessly mutilating and is rarely employed.

Explorations of the knee so much resemble abdominal explorations that the term "laparotomy of the knee-joint" is well justified. The patella can by comparison be looked upon as the rectus muscle, and accordingly our approach to the parts beneath can be lateral, central, or transverse, depending upon the access desired. As in abdominal lesions, exposure of the knee-joint should be so planned that the operation will be in every sense exploratory, and for that reason a transpatellar arthrotomy has the same merits as a transrectus laparotomy.

Spine of tibia injury is relatively rare and is frequently associated with rupture of the crucial ligaments, principally the anterior crucial. Robert Jones says that Godlee in 1888 first called attention to this lesion in a limb that had been amputated by Erichsen fifteen years previously. In all probability the tibial spine is avulsed in many cases of dislocation of the knee, and it may also be an accompaniment of intra-articular fractures of the head of the tibia. Hence severe forms of violence are producing causes, and doubtless the diagnosis is shrouded in the synovitis which inevitably appears, and the differential diagnosis rests between this and crucial ligament injury, bearing in mind that the latter and tibial spine avulsion may coexist. Robert Jones in 1913 reported having seen 17 cases in three years, and he says: ". . . the most constant sign of fracture of the spine of the tibia is obstruction to full extension. The block feels like a definite bony obstruction and is quite different from the locking which occurs when a dislocated semilunar cartilage is nipped. . . ." He says there are three forms: (1) Avulsion of the tibial spine or its internal tubercle; (2) fracture of the external tubercle of the spine; (3) injury of the spine combined with fracture of the tibial tuberosity. In Class 2, fracture of the external tubercle of the spine, Jones states that it is unconnected with injury of the adjacent ligaments, but that it is sheered off by the external condyle of the femur. The first operation for the repair of a fractured tibial spine and ruptured anterior crucial ligament was performed in 1907 by Hogarth Pringle (Robert Jones).

Treatment is non-operative or operative. Prolonged rest cures most cases, and Jones advises this for a period of two to four months. In severe or resistent cases he sutures the spine by a transpatellar approach, anchoring at the same time the anterior crucial ligament so often coincidently involved.

Corner[1] is an advocate of operation in all cases, believing that disability is lessened and that the associated lesions are thus better treated.

The writer has never seen a case of this sort, but on theoretic grounds at least would place the injury in the operative class mainly because of the associated crucial ligament injury which is best treated by suture, as already indicated.

Loose Bodies.—It is interesting to note that these were first recognized by Ambrose Paré in 1558.[2]

Essentially all are due to disease or trauma. Structurally they may be said to be in the main fibrinous or composed of organized connective tissue which may contain distinctly cartilaginous or bony elements.

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[1] Jour. Amer. Med. Assoc., lxiii, No. 13, September 26, 1914.

[2] Ref. Handbook Med. Sci., vol. 5, p. 295.

Numerically they may be solitary or may number many hundreds; Berry in 1894 removed 1047 from a man kicked by a horse. In size they vary from a pinpoint to that of an egg. In location they may be found in any part of the joint; they may be wholly free, dangling from a pedicle or more or less attached as an excresence.

In duration they may be ancient, moderately old, or recent.

In incidence as to age, sex, or occupation they generally are found in males between twenty and forty-five, in the active or the sedentary; clinically, however, most cases are found in active healthy workingmen or athletes.

The chief diseases with which they are associated are rheumatoid arthritis, osteo-arthritis, Charcot's joint, some neuropathies, osteochondritis. Certain definite but etiologically undetermined causes may also be productive, such as osteochondritis dissecans, first described by Koenig in 1887; in this a definite body is found under the femoral condyle in a niche, and this is supposed by some to arise from a circumscribed necrosis due to the plugging of terminal vessels. I operated on such a case recently. Weir reported 2 cases sarcomatous in type, and he first called attention in 1892 to the peculiar organization of the subpatellar fat and fringes so well recognized and emphasized later by Corner and others. Certain fatty bodies also develop in the synovial fringes, and this condition is called lipoma arborescens.

From traumatic sources loose bodies originate from:

(1) Synovitis in the form of fibrous tissue, fat, hyaline cartilage, or bone.

(2) Synovial tears or contusions, a fibrinous clot later becoming converted into cartilage or bone, which may become wholly detached or remain pedicled. This form is rare.

(3) Semilunar cartilage detachment which is ordinarily incomplete.

(4) Articular cartilage separated from the femur, tibia, or patella.

(5) Foreign bodies introduced from without.

(6) Articular fracture of the femur or tibia.

From a practical standpoint the loose bodies consequent upon synovitis, articular cartilage, or semilunar detachment are the most frequent, and give rise to symptoms of a relatively constant, almost classical type.

Symptoms.—The typical combination is pain, synovitis, weakness and slipping, or locking followed by re-effusion.

Pain may be constant, intermittent, localized, or diffuse. Certain motions and pressure may increase it. In type this pain may be dull, or it may be stabbing, and at times exceedingly severe in its darting character. Pressure may elicit tenderness, and when this occurs, valuable corroborative evidence is given.

Synovitis is rarely extreme unless a severe attack of locking occurs. Usually the synovial pouch is rather uniformly distended and a feeling of thickening rather than fluctuation is obtained. Crepitation may or may not exist.

Weakness is common and the patient is not sure of the joint, notably in going up and down stairs.

Slipping may be marked or trivial.

Locking may be complete, but is generally incomplete, so that the flexed position does not require much self-manipulation for correction. Attacks of marked locking requiring surgical aid are relatively rare except in displacement of a semilunar. Such an occurrence is not the rule in ancient cases because the joint cavity in these is so distended by repeated irritation that the offending body usually has plenty of space for wandering about.

Re-effusion is most marked when the offender has caused considerable reaction because it becomes nipped, pinched, or imprisoned in a space where bone ends normally contact; for this reason the most massive re-effusions occur from irritation of the inner side of the joint.

Certain accessory symptoms may also occur, and of these the most important are: (1) Increased motility of the joint as expressed by undue anteroposterior, lateral, or rotatory motions; (2) palpatory evidences of a loose body, often first located by the patient.

x-Ray examination may fail to give any information of value unless the loose body is bony or more or less opaque. Occasionally the margins of the articulation may be so irregular that erosion from within is suggested. As already indicated, injection of oxygen into the joint will often bring into view loose bodies otherwise invisible. This procedure has the added value of allowing us to aspirate the joint contents so that the synovitis is relieved and the joint exudate can be examined microscopically if desired.

Treatment.—Palliative measures have no certain value, and in selected cases operative removal by the transpatellar approach is the method of choice. The indications for operation may be said to be:

(*a*) Palpatory or x-ray evidence of loose body.

(*b*) Continued intra-articular mischief that cannot be ascribed to constitutional causes.

(*c*) A combination of continued or intermittent pain, synovitis, weakness, locking, and re-effusion.

Conclusions.—1. Mono-articular lesions of the knee not definitely tubercular, syphilitic, neuropathic, or metastatic are presumptively surgical as to origin and cure.

2. Synovitis due to indirect violence is very often an end-result of intra-articular damage represented by lesions of the semilunar or their contiguous spines, crucial ligaments, or articular cartilages.

3. A prolonged combination of pain, synovitis, weakness, slipping, or locking is indicative of intra-articular irritation from a detached or pedicled body.

4. x-Ray examination of the oxygen-injected joint is a valuable diagnostic aid.

5. Joint effusion is best treated by immediate aspiration and mobilization.

6. Operative exposure to be of greatest value should be by the transpatellar route, which gives access to the entire joint cavity.

7. Early mobilization following operation is an essential to success.

8. Operative attack demands ultra-asepsis.

CLINIC OF DR. WILLIAM A. DOWNES

St. Luke's Hospital

JEJUNOSTOMY: ITS VALUE IN THE TREATMENT OF CERTAIN ULCERS OF THE STOMACH AND AS A PALLIATIVE MEASURE IN INOPERABLE CARCINOMA OF THE STOMACH

FULL HISTORY AND DISCUSSION OF TWO CASES; DESCRIPTION OF TECHNIC OF OPERATION

I wish to present 2 patients illustrating the value of jejunostomy in the treatment of certain ulcers of the stomach, and to call attention to the use of this procedure as a palliative measure in inoperable carcinoma of the stomach. Also to describe the technic which in our hands has proved satisfactory.

CASE I

The first patient, A. J., colored, aged eighteen. Admitted to the Medical Service on March 3, 1921.

Chief Complaint.—Pain in epigastric region and vomiting. Present attack of three weeks' duration.

Present Illness.—Three weeks ago patient had a dull gnawing pain in epigastric region, which radiated to the left shoulder and into the back. Pain came on one to one and one-half hours after meals. Not relieved by food, but slightly relieved by taking a cup of hot milk. Irregular vomiting, but vomitus did not contain blood. Stools tarry. Rapid loss of strength, with shortness of breath. Remained in bed three days before he came to the hospital.

Past History.—Pain in stomach first began three years ago, and at that time was treated at the Presbyterian Hospital for two and one-half weeks. Nine months later pain returned, and was again treated for one week at the same hospital. One year ago received electric treatment at the Neurologic Institute. Shortly afterward was in the New York Hospital for two weeks, where he was put on a diet and remained free from pain up to the present attack. Pneumonia five months ago. No other illness. Denies venereal diseases.

Family History.—Negative.

Physical Examination.—Patient is a much undernourished and underdeveloped negro boy, aged eighteen, lying quietly in bed and appearing acutely ill. Lips and mucous membranes ashen gray. No cyanosis, no petechiæ, no jaundice, no edema, no dyspnea.

Posterior cervical, axillary, and inguinal glands felt. Thyroid not felt.

Eyes.—Pupils regular, equal, contracted, react to light and accommodation. Extra-ocular movements normal.

Teeth.—Dirty and carious. Tongue dirty, tonsils enlarged.

Abdomen.—No masses. Somewhat scaphoid. Has marked tenderness in the epigastrium and there is rigidity of the right upper rectus. Liver, kidneys, and spleen not felt.

Weight, 84 pounds.

Laboratory Findings.—Red blood-cells, 2,400,000. Hemoglobin, 32 per cent. Morphology normal. Stool for blood, guaiac 3+ positive. Wassermann negative.

Roentgen-ray Examination.—There is marked deformity of the stomach. The pyloric end and lesser curvature indicate gastrospasm. The appearance of the lesser curvature suggests the possibility of perforating ulcer. The findings are sufficient to indicate the advisability of surgical intervention. The condition of the patient was such that fluoroscopic examination was not permitted. The plates were taken only in a prone position. The stomach emptied at a fair rate. There is a retention of about one-quarter of the meal at the end of four and one-half hours.

Provisional Diagnosis.—Bleeding ulcer of the stomach. Location, lesser curvature and posterior wall. The patient was put on an ulcer diet (Bastedo), and on March 11th was given a blood transfusion of 13 ounces, and on March 19th another, of

12 ounces. There was only a slight improvement following the transfusions, and as his general condition seemed to be getting worse rather than better, he was transferred to the Surgical Service on March 25th, and was operated upon on the same day.

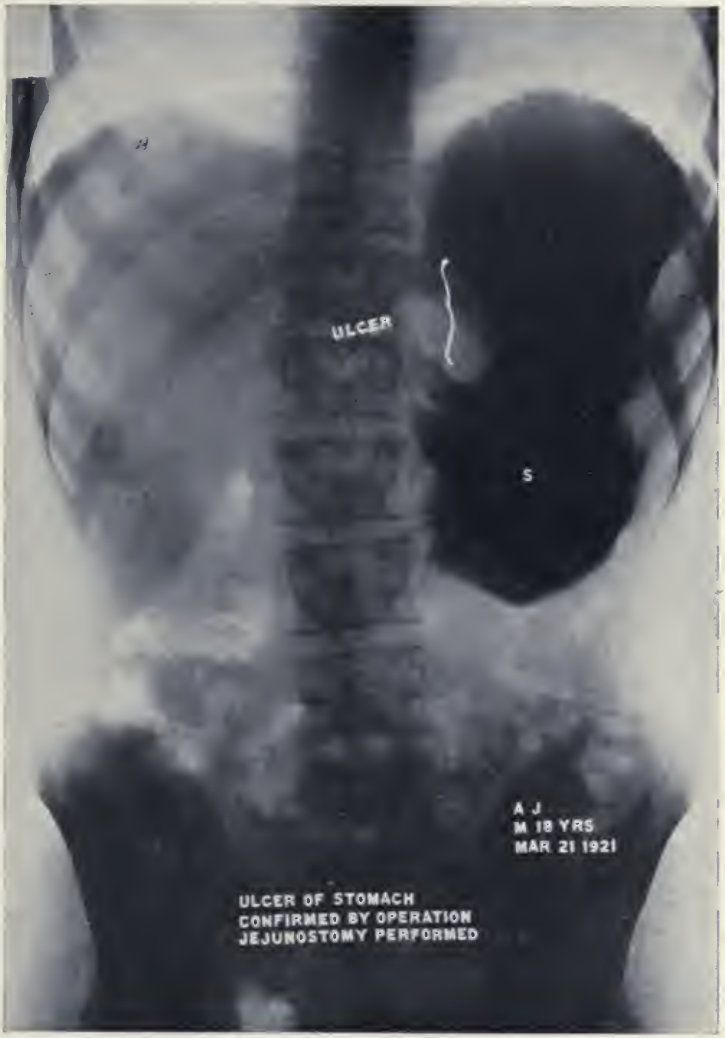

Fig. 699.

Operation.—Gas and oxygen anesthesia. Exploratory gastrotomy, jejunostomy. Five-inch upper right rectus incision.

Pathologic Findings and Operative Procedure.—Dense perigastric adhesions between the lesser curvature of the stomach, the parietal peritoneum, and liver. A large indurated mass could be felt involving the lesser curvature and posterior wall of the stomach and apparently adherent to the pancreas. Pylorus patent and not involved; duodenum normal. A 3-inch incision was made in the middle of the anterior wall of the stomach exposing the ulcer crater. The ulcerated area was about 3 inches in diameter and extended well up on the posterior wall and lesser curvature (Fig. 700). On account of the size and location of the ulcer, excision was impossible. The opening in the stomach was closed by a continuous suture of chromic catgut, and the question of gastro-enterostomy considered, but, on account of the extent and location of the ulcer and the fact that absolute rest of the stomach was necessary in order to control the bleeding, which was the most important indication, this operation did not seem to meet the requirements. We therefore decided to perform jejunostomy, thereby placing

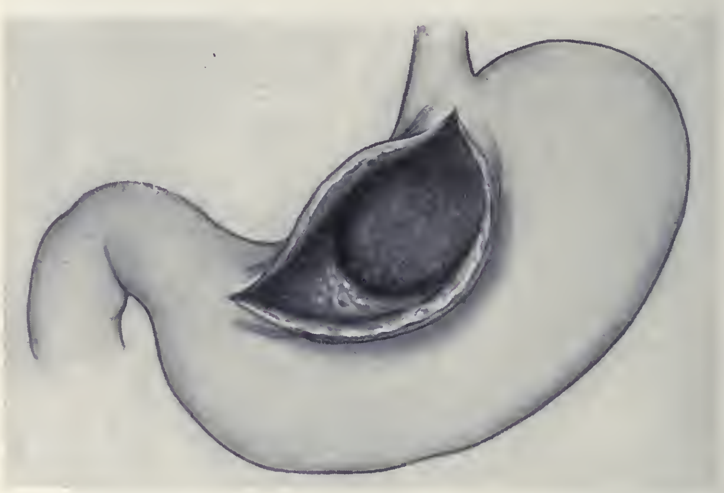

Fig. 700.—Illustrating location of ulcer in Case I.

the stomach at absolute rest in the hope that the bleeding might be controlled.

Postoperative Treatment and Course.—Feedings through the tube in the jejunum were begun in twenty-four hours; 4 ounces of milk was given every two hours, gradually increased to 8 ounces, with addition of eggs, meat juice, and cereal. Small quantities of water were allowed by mouth. Continuous Murphy drip of 5 per cent. glucose. Three postoperative transfusions were given at intervals of two weeks. Wound healed by primary union. Convalescence was slow, but satisfactory.

June 21, 1921.—Three months after operation red blood-cells 3,000,000, hemoglobin 45 per cent. Stools negative for blood.

Discharged from hospital on July 1st, having gained 10 pounds in weight and general condition much improved. At that time was allowed small quantities of milk, ice-cream, and broth by mouth, in addition to regular three-hour interval feedings through tube.

Has been returning to the hospital weekly since discharge. The same routine feeding has been kept up with moderate increase of amounts of food by mouth. Tube has been removed from time to time to be cleansed. There has been no irritation of the skin and no leakage from the stoma.

At this time (November 15th) patient appears to be in excellent health. Has gained 36 pounds in weight, and has returned to his work as chauffeur.

Laboratory Findings (November 15, 1921).—Examination of stool for blood is negative.

Gastric analysis, fasting: Free hydrochloric acid, 0. Total, 10. Guaiac, +. Test-meal: Free hydrochloric acid, 30. Combined hydrochloric acid, 40. Total, 70.

Blood count as follows: Red blood-cells, 4,600,000. Hemoglobin, 74 per cent. White blood-cells, 7000. Polynuclear leukocytes, 60 per cent. Lymphocytes, 38 per cent. Eosinophils, 1 per cent. Basophils, 1 per cent. Morphology normal.

***x*-Ray findings** (October 15, 1921) showed the following: Fluoroscopic and radiographic examination indicate a most remarkable improvement in the contour of the lesser curvature. The irregularity and tendency to the formation of a crater have entirely disappeared. The pyloric end of the stomach, however, is irregular in contour—in all probability due to the retraction

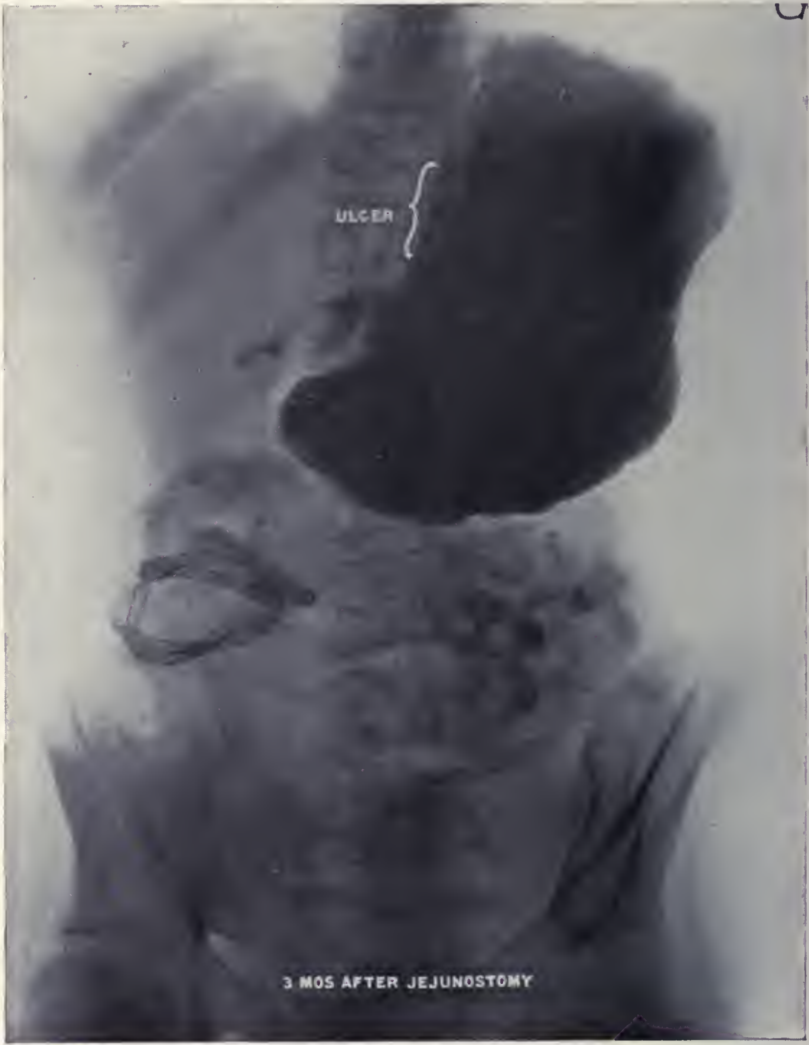

Fig. 701.

resulting from the healing of the ulcer. The greater curvature of the stomach is well rounded out. The stomach begins to empty readily. The exposure made at three and one-half hours shows almost the entire meal has left the stomach and entered the colon. The tube in the jejunostomy opening remains in

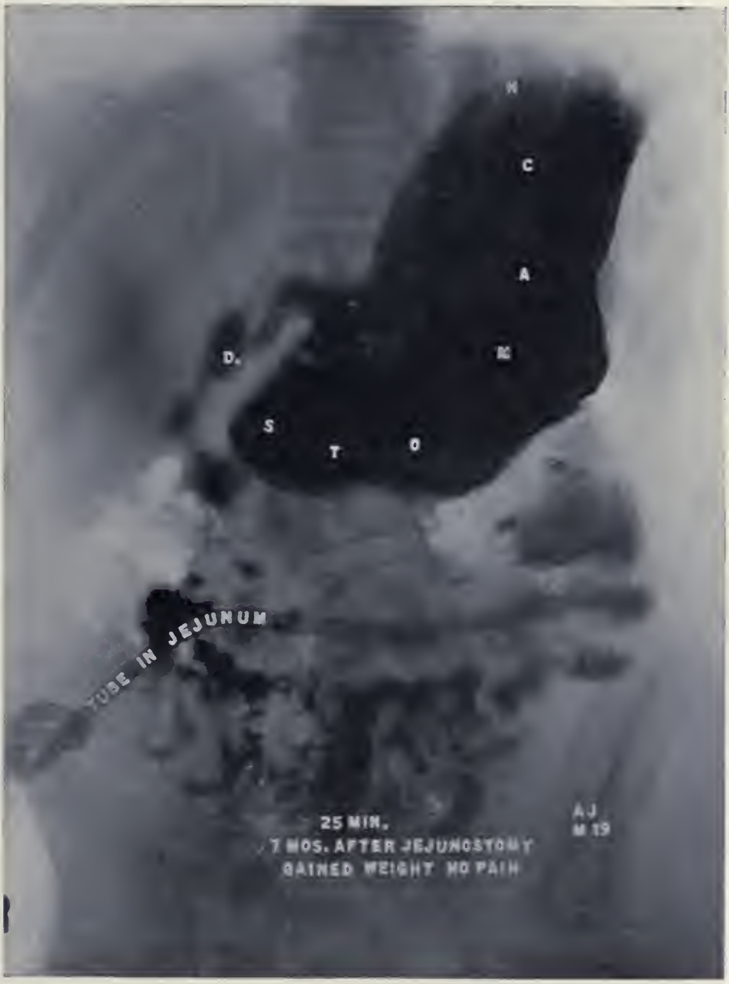

Fig. 702.

position and there is no difficulty in food from the stomach passing this point.

Summary.—The large gastric ulcer has apparently healed. The stomach functions well when filled with a full opaque meal in spite of some retraction of the pyloric end apparently associated with the healing of the ulcer.

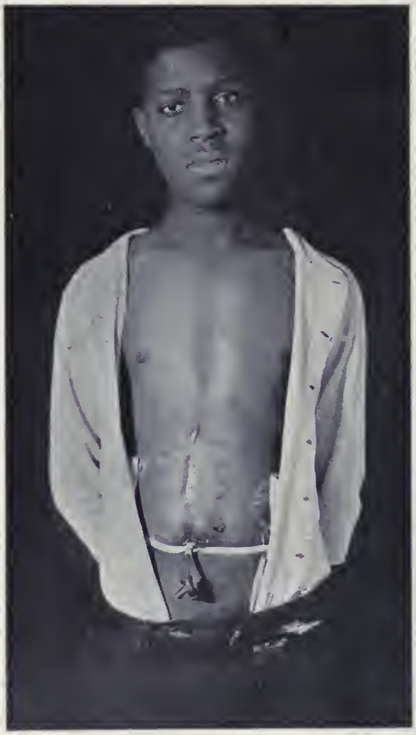

Fig. 703.—A. J. Aged eighteen. Eight months after jejunostomy.

While these examinations show conclusively that the ulcer has ceased to be active, we are not satisfied that it has entirely healed, and for this reason propose to keep the jejunostomy open at least one year from the date of operation.

CASE II

The second patient, W. T., aged fifty-two, occupation builder, was admitted to the hospital November 1, 1921.

Chief Complaint.—Pain in the left upper quadrant, most marked when lying on right side.

Present Illness.—Dates from August 12, 1921, at which time he began to suffer from sour stomach with burning in the throat. Appetite has remained good, but there has been continuous loss of weight and strength. Pain comes on one hour after eating and is only temporarily relieved by the taking of food.

Past History.—Typhoid at eighteen. Scarlet fever, mumps, and measles. Suffered from numerous boils during the year 1912. Habits good. Denies venereal disease.

Family History.—Mother died at sixty-four years of "heart disease." Father died at eighty-one years of "stroke." No tuberculosis or cancer.

Physical Examination.—Well-developed white male. Good muscles, color pale, skin sallow. Pupils normal. Tongue coated, teeth good. Nose and throat show marked catarrhal inflammation. Tongue bad. Sinuses darkened. Heart normal. Blood-pressure: Systolic, 100; diastolic, 70. Lungs clear. Abdomen soft. Slight tenderness over the appendix area. Reflexes normal. Rectal examination shows hemorrhoids. Proctoscopic negative. Double inguinal hernia. Genitals normal. Weight 145 pounds.

Laboratory Findings.—*Urinalysis:* Acid, 1015. Albumin faint trace. Sugar negative. Stool positive for blood.

Gastric analysis, fasting: Blood-guaiac 3+ positive. Test-meal (Ewald): Hydrochloric acid, 0. Total acidity, 10.

Blood count as follows: Red blood-cells, 2,700,000. Hemoglobin, 50 per cent. Morphology normal. Wassermann 4+ positive.

Roentgen-ray Examination.—Persistent filling defect at the pylorus probably due to spasm. No retention at six hours. Before admission to hospital had been on antiluetic treatment without benefit. Weight had fallen from 161 pounds to 145 pounds in two and one-half months.

Exploratory operation advised and accepted.

Provisional Diagnosis.—Carcinoma of the stomach.

Operation (November 5, 1921).—Gas and ether anesthesia. Exploratory gastrotomy. Jejunostomy. Five-inch upper right rectus incision.

Pathologic Findings and Operative Procedure.—No adhesions. Liver appeared normal. No glandular enlargement. Pyloric portion of stomach normal. An indefinite mass could be felt occupying the cardiac portion of the greater curvature. The stomach was explored through a 3-inch incision in the middle of the anterior wall. An ulcer the crater of which was fully as large as the palm of a hand could be seen high up on the posterior wall and greater curvature (Fig. 704). On account of its inacessibility no attempt was made to remove a section. As it was impossible—both on account of the size and location of the growth—to perform a radical operation, it was decided to do a jejunostomy. Complete rest of the stomach was indicated in order to control the bleeding.

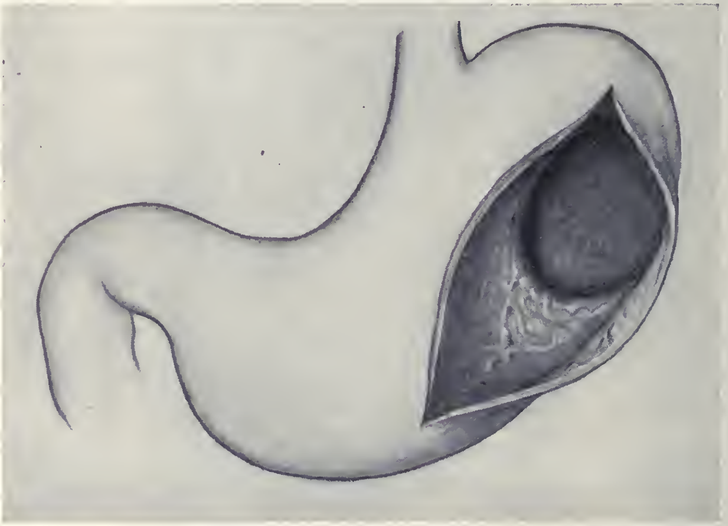

Fig. 704.—Illustrating location of ulcer in Case II.

The postoperative treatment has been carried out the same as in the first case. Convalescence has been rapid. In three weeks there has been an increase of over 1,000,000 red blood-cells and the hemoglobin has gone up 10 points.

We will be guided as to the future care of this patient by the laboratory and Roentgen-ray findings. If everything goes well we expect to keep the jejunostomy open for from six months to one year.

DISCUSSION

Ulcer of the stomach in individuals as young as eighteen is very rare. Lockwood states that in 100 private cases of gastric and duodenal ulcer only 2 were under twenty years of age.

There is little or nothing in the history of our first case to throw light upon the etiology. The oral sepsis or enlarged tonsils might be the cause. It was first thought that syphilis might be the causative factor, but repeated Wassermann examinations have been negative, and there are none of the usual stigmata of congenital lues. The one feature suggestive of syphilitic origin was the presence of the extensive perigastric adhesions found at operation, but the ulcer itself was single, whereas in syphilis there are usually two or more ulcers in varying stages of healing.

In the second case there is a fair chance that the ulcer is of a syphilitic nature, and for this reason we believe that under appropriate treatment and with complete rest of the stomach we may be able to obtain a cure. At any rate, it seemed wiser to treat the patient on the assumption that it is not malignant. If it should turn out to be cancerous, no harm has been done.

The value of jejunostomy in the treatment of large gastric ulcers situated on the posterior wall and greater curvature was called to my attention by a case shown before the New York Surgical Socity by Dr. Lilienthal (Annals of Surgery, vol. 61, 1915). Gastro-enterostomy had been previously performed on this patient without relief of symptoms, and he was later relieved—if not entirely cured—by jejunal feeding. While the field for jejunostomy in the treatment of chronic diseases of the stomach may be a limited one, yet the indications are clear, and in properly selected cases it is a life-saving procedure. In itself it may prove to be a curative measure or it may tide the patient through a critical period until such time as an elective operation can be performed. As a palliative procedure in cancer of the cardiac portion of the stomach jejunostomy is superior to gastrostomy, for the reason that it gives the stomach complete rest, and if properly performed does not leak.

TECHNIC OF JEJUNOSTOMY

A loop of the jejunum about 12 inches from the duodenum-jejunal angle is drawn out of the wound and grasped on its convex surface by two pairs of Allis clamps placed opposite each other and about ¾ inch apart. A third Allis clamp is now placed 4

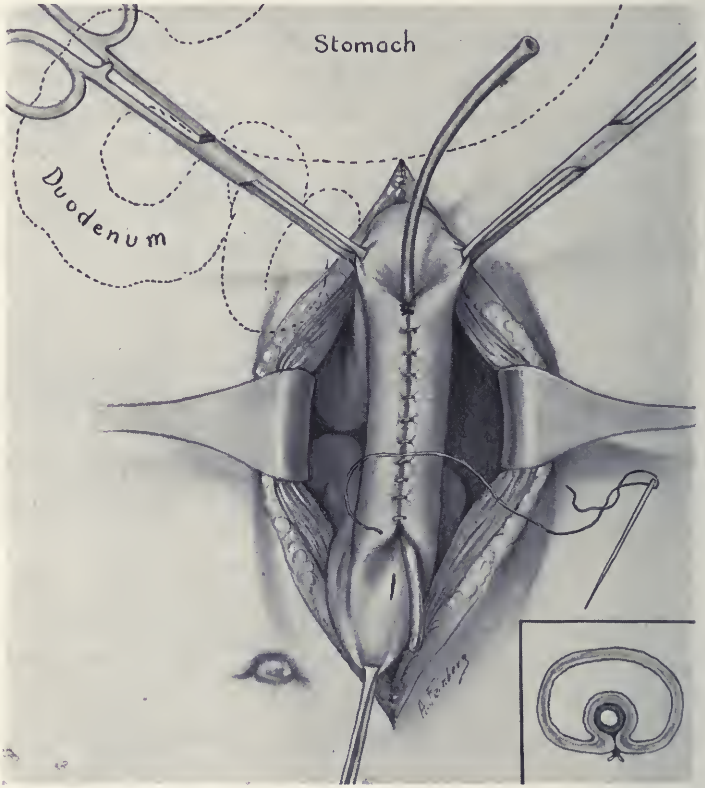

Fig. 705.—Jejunum supported by Allis clamps, about 3 inches of catheter infolded. Note small incision for passage of catheter into lumen of gut. Insert: Cross-section of intestine with embedded catheter.

inches distal to the first two, grasping the gut wall in its center, that is, at a point equidistant from its mesenteric attachment. Thus supported, the terminal 4 inches of a No. 16 French catheter is placed along the intestine and embedded in its wall by a continuous silk suture in a manner similar to Witzel's gastrostomy. This suture is started just distal to the two clamps and should include only enough tissue to completely embed the catheter, care being used not to encroach too much upon the lumen of the gut. After the suture has been continued for about 3 inches a ¼-inch stab wound is made through the intestinal wall and the terminal inch of the catheter thrust into its lumen—the suture is then continued down to the single Allis clamp. The intestine is now dropped back into the abdomen, and anchored to the peritoneum about opposite or a little below the umbilicus by four silk sutures placed around the point where the catheter emerges from the trough in the gut. The abdominal incision should be made preferably through the left rectus muscle, but if it has been placed to the right of the

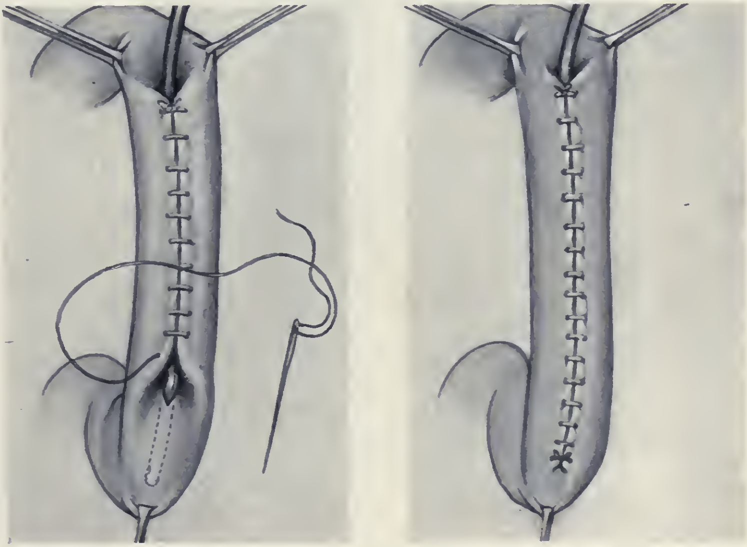

Fig. 706.—Catheter inserted into intestine. Suture completed.

median line it is not necessary to made a second incision. The catheter is caught to the fascia by an encircling suture of chromic gut and to the skin by a second one of silk. A transfixion suture is not used, as it may result in leakage. We have now used this method in 6 cases. There has been little or no leakage. The catheter is easily held in place by a narrow adhesive strip after sutures are removed. It should be removed occasionally for cleansing, but should never be left out until it is time to let the stoma close. We have had no difficulty in reintroducing the catheter.

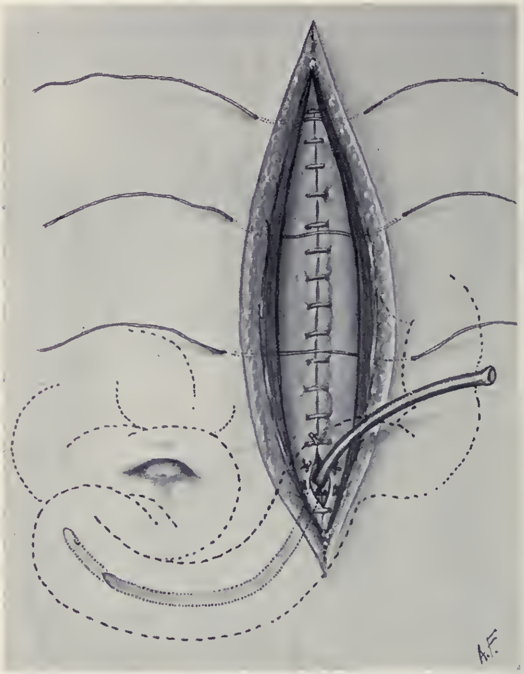

Fig. 707.—Jejunum attached to parietal peritoneum.

CLINIC OF DR. R. W. BOLLING

St. Luke's Hospital[1]

FIBROCYSTIC LESION OF UPPER PORTION OF SHAFT OF FEMUR

Recurring Fracture Through Fibrocystic Lesion of Upper Portion of Shaft of Femur. Persistence of Lesion Following Union of Fracture. Open Operation with Sliding Bone-graft.

The patient whom I present to you today is shown not only because the condition is relatively uncommon, but because the treatment in this instance furnished a problem of some interest.

He was first admitted to St. Luke's Hospital six years ago, when he was fifteen years old. The day before admission, while running, he felt his left thigh give way; he fell to the ground and was unable to get up. Two weeks previously he had fallen down an areaway, but had felt no ill effects other than a dull pain in his hip. His history was otherwise entirely negative save for the fact that when he was nine years old he broke his right arm in the region of the elbow.

On admission he was found to have a fracture through the upper portion of the shaft of the left femur. At this time he was under the care of Dr. Richard Derby. He was treated by means of Buck's extension for twenty-three days, at the end of which time a plaster-of-Paris spica was applied. Two months later he was discharged with solid union and $1\frac{2}{3}$ inches shortening.

The radiographic report by Dr. Le Wald on admission is as follows: "There is apparently a pathologic fracture involving the left femur at the juncture with the neck. There is a peculiar rarefied appearance to the bone in this region suggesting decalcification such as occurs in bone cyst or in new growth." Four months after the fracture Dr. Le Wald reported: "The fracture appears to have entirely united with some callus formation. There are still peculiar rarefied areas in the femur over the upper third and extending into the greater trochanter and the neck." Eighteen months after the fracture Dr. Le Wald states: "There is still some evidence of rarefaction of the upper third of the femur and slight productive changes along the inner surface of the bone in the region of the fracture." Unfortunately, these radiographic plates were destroyed.

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[1] Service of Dr. William A. Downes.

Following his discharge from the hospital the patient led an apparently normal active life, his only disability being a slight limp, which was corrected by a raised inner sole. Eighteen months ago he was readmitted to Surgical Division A, St. Luke's Hospital, and assigned to me for treatment. Two days before admission he slipped on the ice, falling on his left hip. Following this fall there was a dull ache in his hip. The next morning he slipped on the stoop and fell down several steps. The left thigh felt as though it gave way under him, and although he had no pain other than a dull ache in his thigh, he was unable to use the leg and knew from previous experience that it was broken.

On admission he was found to have a fracture through the upper portion of the shaft of the left femur at the level of the lesser trochanter. There was 2¾ inches actual shortening. Otherwise his physical examination was negative. He was well developed and nourished, and the usual laboratory tests were made and found to have no bearing on his present condition.

The report by the radiographer, Dr. Le Wald, on admission is as follows: "There is a pathologic fracture passing through the upper portion of the shaft of the femur at the level of the lesser trochanter, with upward and outward displacement of the lower fragment. The markedly cystic rarefaction of the upper portion of the shaft of the femur is evident, and is of about the same appearance as that noted in the radiograph taken three years ago. In view of the long standing of the condition it probably represents a bone cyst."

A Thomas splint with adhesive traction was applied, with the thigh flexed, abducted, and rotated outward. This position was maintained by means of an overhead frame, and at first a 30-pound weight was used. This was subsequently reduced. The method of traction was that described and pictured by Dr. Blake in his book on Gunshot Fractures of the Extremities.

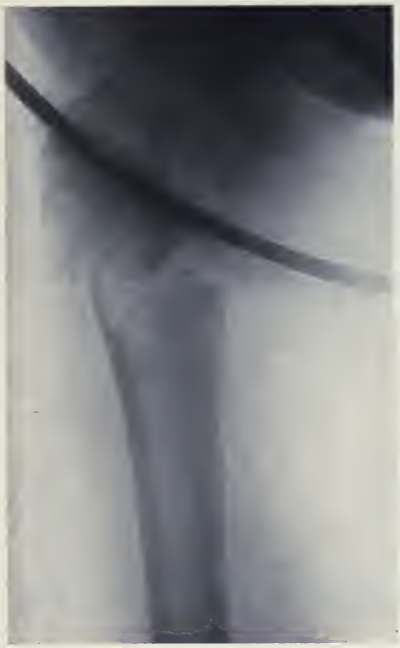

Fig. 708.—Ten days after fracture.

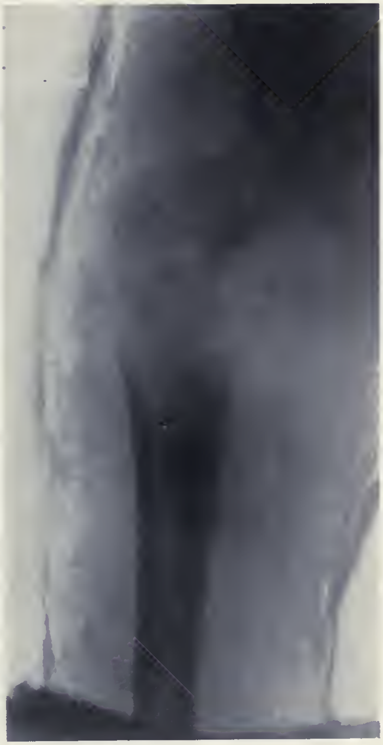

Fig. 709.—Two months after fracture.

Figure 708 is a radiograph taken ten days after admission, with the extension apparatus in place. A plaster spica was applied six weeks after fracture.

Figure 709 was taken two months after fracture and showed the position to be good, with no apparent shortening, but little regeneration of bone.

After eight weeks the plaster spica was removed and union seemed solid. Dr. Le Wald at this time reported that rarefaction in the upper portion of the shaft was still marked. One month later and four and one-half months after his fracture the patient was discharged with apparently solid union and 1½ inches shortening, about the same amount noted on his previous discharge.

During the next six months radiographs were made at frequent intervals. The rarefied areas remained noticeable in the upper portion of the shaft of the femur, tending rather to increase than to decrease. At this time radiographic examination of the entire skeleton was carried out and no further cystic areas were found.

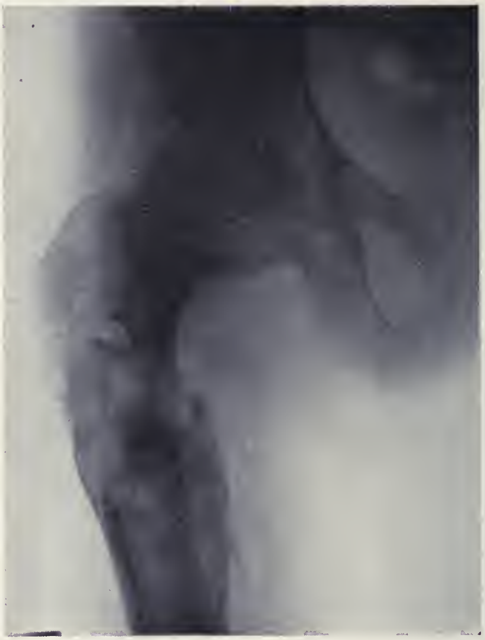

Fig. 710.—Ten months after fracture.

Figure 710 represents the condition of the bone at this time. There was a well-defined and trabeculated cystic area in the upper extremity of the femur, not involving the epiphysis and without change in the surrounding bone and periosteum. This, with the five-year history and the age of the patient, made the diagnosis of a fibrocystic lesion practically certain. Operation was decided on, and the patient was readmitted to the hospital.

Four days after admission and ten months after the fracture, under gas and ether anesthesia, an incision was made along the outer side of the thigh, exposing the upper half of the outer aspect of the left femur. For a distance of about 4 inches the upper portion of the femur, including the greater trochanter and the shaft immediately below it, but not the neck, was involved in the pathologic process; the bone in this region appeared to be irregularly elevated to a slight degree in rounded areas of varying size. The periosteum was apparently intact and slightly, if at all, thickened, and everywhere a shell of bone of varying thickness covered the underlying cavities. The cavities varied in size from that of a pea to one with a diameter of about 1¼ inches. This cavity contained a brownish fluid, which was thin and not viscid. The cavity was lined with a thin layer of rather firm tissue. Other cavities were apparently unlined and some were partly filled with soft, rather vascular, brownish-red material, somewhat resembling very soft granulation tissue, though not so bright in color.

With the motor twin saws a strip including the entire thickness of the bone was cut, about 9 inches in length and ⅜ inch in width, from the lateral aspect of the femur, extending downward from the greater trochanter. The upper portion of this strip included portions of the cystic cavities described above. The cystic portion of the strip was cut away and discarded. The remaining cavities in the shaft of the bone were cureted as carefully as possible, and in certain instances the walls were crushed in. Small fragments of bone obtained from one end of the graft were placed in the cavities. The portion of the graft derived from the sound shaft of the femur was fixed in place in the cystic area by means of three kangaroo sutures passed through holes drilled on either side of the bone channel. In the lower part the graft was fixed below the surface of the femur, this being made possible by the crushing in of the small cysts lying along the bottom of the bone channel. There was very active bleeding from the affected area of bone and the sutures in the muscle were so introduced as to roll muscle into all the inequalities in the surface of the bone. The wound was closed without drainage. A plaster-of-Paris spica was applied.

The microscopic examination by Dr. Knox, the resident pathologist, follows: "Section shows fragments of bone, many of them rarefying, but others surrounded with a normal number of osteoblasts. The stroma all shows an inflammatory reaction. There is no normal marrow except a small amount of fatty tissue, and this contains large dilated sinuses, but very few cells. There is a small amount of periosteum which also is involved in the inflammatory process. There has been considerable hemorrhage and many pigmented cells which are indicative of it. There are no cells which indicate a tumor process.

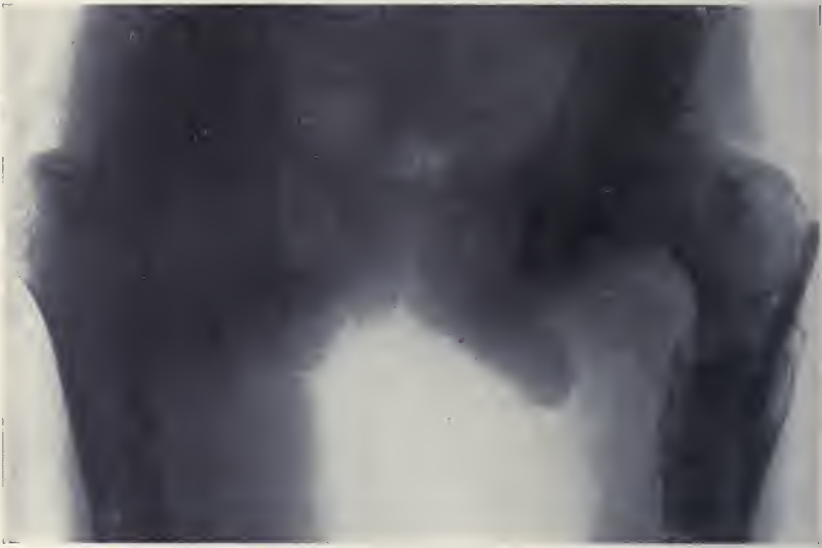

Fig. 711.—Six weeks after operation. Bone-graft.

The wound healed by primary union throughout. Convalescence was complicated by a severe attack of tonsillitis. On the eleventh day a fluctuant area was noted at the lower angle of the incision and 90 c.c. of serosanguineous fluid withdrawn. Culture remained sterile. Five days later 120 c.c. of similar fluid were withdrawn and culture showed Staphylococcus albus, a probable contamination, as a few days later a third and last aspiration obtained 50 c.c. of similar fluid, of which a culture remained sterile. There was no further complication and the patient was discharged eight weeks after admission.

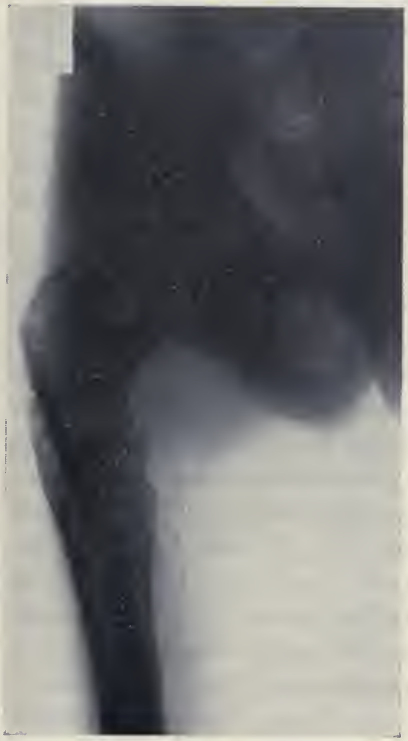

Fig. 712.—Three months after operation. Bone-graft.

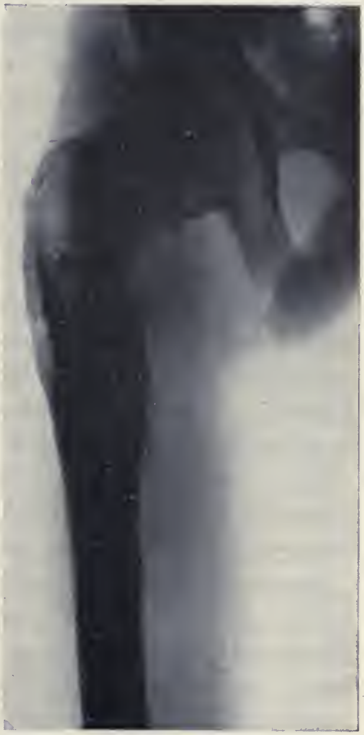

Fig. 713.—Six months after operation. Bone-graft.

Figure 711 is a radiograph of condition at this time.

Figure 712 shows condition two months later, at which time Dr. Le Wald states: "The bone-graft is well incorporated, but its identity can still be made out. There is an increase in new bone structure where rarefaction has previously been noted."

Figure 713 shows condition three months after Fig. 712 and six months after operation. Dr. Le Wald reports at this time: "The bone shows marked filling in of lime salts, but the graft can still be made out." The patient, as you see, has a slight limp, which can be corrected by an inner sole. Otherwise he appears to be in normal health.

Discussion.—The fibrocystic lesion in the femur of the patient whom I have presented to you illustrates a type of lesion which is particularly important from the standpoint of the surgeon. A discussion of bone-cysts in general would involve a review of a large part of the pathology of the morbid conditions in bone, and I shall limit myself to the particular type of lesion of which I have shown you an example today. I would refer those interested in a broader discussion of the subject to the numerous articles by Bloodgood and Barrie and others.

The etiologic factor in fibrocystic bone lesions is not known, but from the evidence adduced by various observers, notably Bloodgood and Barrie, it seems reasonable to assume that the lesion is inflammatory. Trauma is given as a causative factor; if that is the case, it would seem to serve merely in a contributory way, or the condition would be much more frequently observed than it is. There is probably some relation between giant-cell tumor of the bone or hemorrhagic osteomyelitis and fibrocystic lesions of the bone. It is possible that they are different stages of the same process and that the fibrocystic lesion, as Barrie suggests, represents partial cure. The condition occurs most frequently in those under twenty, though it may occur at any age. It is most frequently found in the femur, humerus, and tibia, though it has been found in practically every bone in the body. With few exceptions it does not involve the epiphysis.

Probably most frequently the condition is brought to light following a fracture at the site of the lesion. In those cases discovered by chance or investigated on account of the symptoms the history is usually of little or no pain. There may be local tenderness and possibly localized enlargement. If near a joint, there may be some limitation of motion. If a fracture does occur, there is usually rapid consolidation, with a marked tendency to obliteration of the fibrocystic area. The radiograph is of the greatest aid, and taken in conjunction with the clinical history may often enable one to arrive at a reasonably certain diagnosis. The lesion is usually round or oval, may be trabeculated, is well defined, and without changes in the surrounding bone or periosteum. Occasionally the cortex is perforated, but if so, there is no bone production beyond it.

In differentiation it is well to remember that a central gumma, which may otherwise resemble a fibrocystic lesion, usually, though not always, shows periosteal deposit of bone, as is also usually the case with an isolated bone abscess. An isolated tuberculous process may be difficult to differentiate, but it is frequently not oval or circular in outline, as is the fibrocystic lesion, its outline is not so definite, and frequently the periosteum is perforated and there is a resulting tuberculous abscess. The differentiation from a central sarcoma is often difficult, but the fact that there is rarely if ever periosteal overgrowth, with spicules of bone showing in fibrocystic lesions, may be of help. Often diagnosis can only be arrived at after exploration. Radiographic examination of the entire skeleton must be carried out to eliminate multiple lesions.

Treatment should be conservative. In the event of a fracture through the lesion, the fracture should be treated as any fracture of the region involved. In a considerable proportion of cases the fibrocystic lesion will gradually disappear as a result of the trauma. If there is no fracture the lesion should be studied at intervals by means of the *x*-ray with the possibility of spontaneous healing in view. When the diagnosis is in doubt, when the lesion is progressive or shows no evidence of healing after a reasonable period of observation, exploration should be undertaken. The diagnosis may be frequently made from inspection at the time of operation; it should, however, always be confirmed by the pathologic examination of material removed. The lesion, according to Bloodgood, may consist of a bone-shell without connective-tissue lining, with a connective-tissue lining, or the shell may be filled with a solid mass of fibrous tissue.

The microscopic picture of the connective tissue in either case is identical. Involvement of the periosteum is suggestive of malignancy, as is ossification within the lesion or beyond the periosteum. The giant-cell tumor shows the characteristic granulation tissue. Other conditions which may be encountered are chondroma and myxoma, the latter being very rare. Skeletal metastases of a malignant tumor of the soft parts, though usually clearly indicated in the history, must be borne in mind. Echinococcus cyst of the bone has also been occasionally encountered.

When the diagnosis has been confirmed at operation, the cavity or cavities should be cureted out, the walls crushed in, and the wound closed without drainage. If possible, in suturing the muscles it is well to so introduce the sutures as to roll muscle tissue into any dead space that may result from the crushing in of the walls of the cyst. It does not seem necessary to swab out the cavities with phenol or other chemicals. In certain cases where the treatment outlined would, if carried out thoroughly, so weaken the bone as to make fracture probable, it is desirable to use an inlay bone-graft, either of the sliding variety or, if this is not practicable, one removed from a sound tibia. Complete resection seems unnecessarily severe.

In the patient whom I have shown you I had to deal with a fibrocystic lesion which had apparently persisted for five years in spite of two fractures. Careful observation for ten months following the last fracture revealed no evidence of obliteration of the cystic cavities save immediately adjoining the line of fracture, and the appearance of the radiographs was such as to strongly suggest the possibility of a third fracture in the event of even slight trauma. The simple operation of cureting and crushing in the walls of the cavities if carried out thoroughly would have weakened the bone to such an extent as to render accidental fracture probable. Complete resection of the involved segment was discarded as unreasonably severe. The operation which I have detailed was undertaken as meeting the indications in this particular instance with the least danger to the patient.

CLINIC OF DR. HERBERT WILLY MEYER

From the Surgical Service of the New York Skin and Cancer Hospital, Second Division. Service of Dr. George H. Semken

I. CASE OF EPITHELIOMA OF THE OUTER CANTHUS OF THE EYE.

II. CASE FOR THIERSCH SKIN-GRAFTING.

Case I.—In discussing the treatment of epithelioma certain fundamental principles must be laid down.

In the first place, caustic paste may be used to treat epithelioma. This is dangerous because of the uncertainty as to the extent of destruction of the lesion, especially in the depth, and with it the possibility of stimulation of the cancer left untouched and with an increasing activity in growth. The malignancy of the tumor would in this way, of course, be greatly increased. In this method also the opportunity of microscopic study of the lesion is lost, which is a marked disadvantage.

Second, radiotherapy may be employed. This method is uncertain and unreliable because one cannot be sure that there is 100 per cent. destruction of the epithelioma in every case, and if the destruction is not 100 per cent., if only 1 per cent. of cancer-cells remain, then that 1 per cent. is sufficient to develop into a 100 per cent. lesion again. It is impossible to say beforehand if there are any ray-resistant cells present or not. If they are present the radiotherapy will not destroy the cancer 100 per cent., and although the lesion may appear healed and cured for a time, the epithelioma will begin to grow again within the scar tissue and frequently be of a much more virulent variety than the original lesion. Many cases are on record which have been treated by radiotherapy in which there was a recurrence of the tumor.

The third manner of treatment of epithelioma is by surgical excision. This is the method of choice. If it is possible to completely excise the tumor, keeping as far from the deepest portion as from its lateral borders, then it is removed *in toto* at one time, a fundamental principle of cancer surgery. As Handley has shown that cancer is so often present within the fascial planes, it is necessary frequently to excise deeper and wider at the base than at the skin level of the tumor. Cancer is an "enemy," and the camp of the enemy must never be invaded, but must be completely surrounded on *all* sides. By surgical excision one can be as painstakingly certain to remove the deepest portion of the lesion, with a safe margin of healthy tissue beneath it, as one is sure to stay safely distant from the lateral borders. This can be done by a careful examination of the specimen by the surgeon immediately upon its excision, cutting through the growth, and examining in the gross if the excision has been complete and if there is a margin of safety on all sides of the tumor.

The danger of this method of surgical excision is the implantation of cancer-cells on the raw surfaces left behind. This can be practically entirely overcome by the use of what is called the "proper cancer technic." With this is meant that every ulcerating epithelioma must be most carefully protected by first carbonizing the ulceration with the actual cautery and then covering the ulceration with a piece of gauze held in place by mattress sutures, or if these sutures cannot be placed, the gauze may be fastened by clamping the skin edge of the lesion and the edge of the gauze with mosquito clamps as the excision progresses. This protects the ulcerations. The next point in the technic is never to use a forceps on the tissue side with which the tumor side has been handled, as cancer-cells may adhere to the forceps and thus be implanted. Likewise, a hemostat which has clamped a vessel on the tumor side must never be used again until it has been reboiled, and thus any adherent cancer-cell destroyed. The scalpel used should frequently be wiped with an alcohol sponge to destroy and remove any adherent cancer-cells. The wound may be wiped with an alcohol sponge after the excision of the lesion. Thus, if these most important points in the cancer technic are constantly kept in mind, many cases of recurrence following surgical excision caused by cancer-cell implantation on the raw surfaces at the time of the first operation can be avoided. To sum up:

1. Surgical excision is the safest treatment of epithelioma.
2. Cancer-cell implantation, its chief danger, can be avoided by proper cancer technic:
    - (*a*) Covering of ulcerations.
    - (*b*) Never to use the forceps on tissue side which has been used on tumor side.
    - (*c*) To reboil every hemostat used on tumor side before using it again.
    - (*d*) To wipe scalpel and wound with alcohol sponge.
    - (*e*) To keep raw surfaces covered with compresses or towels during the progress of the operation.

In cancer surgery about the eyelids the indications are twofold: First, the growth must be removed in a safe manner, and second, the excised region must be closed by plastic repair. The most important point is that the surgeon who excises the epithelioma must think of nothing else than the radical, complete removal of the cancer, no matter how large the defect or what shape defect he will be creating by so doing. He must never have in mind the thought of how he will close the large defect he is making, as he might then not be radical enough and not excise sufficiently and safely, thinking rather of a pretty plastic repair; and although the repair may be beautiful and complete, a recurrence a few months or years later, for which he is to blame, because he was not radical enough at the time of the first operation, will then surely bring to naught all the fine plastic work he may have done. The surgeon must be Mr. Jekyl while he is excising the cancerous lesion, and, once having radically excised it, he may become Mr. Hyde again and think about the plastic repair.

Having thus outlined the broad general principles of the treament of epithelioma, one may proceed to their application in this concrete case before us this morning.

This patient, a man fifty-seven years old, has an ulcerating epithelioma of the outer canthus of the left eye (Fig. 714). The duration of the lesion is three years. For many years previously he had a wart at the same place, probably a congenital dermatosis, which he pinched off three years ago. It bled some at that time and then began to grow slowly. For the last six months it has been growing faster, and two months ago began to ulcerate.

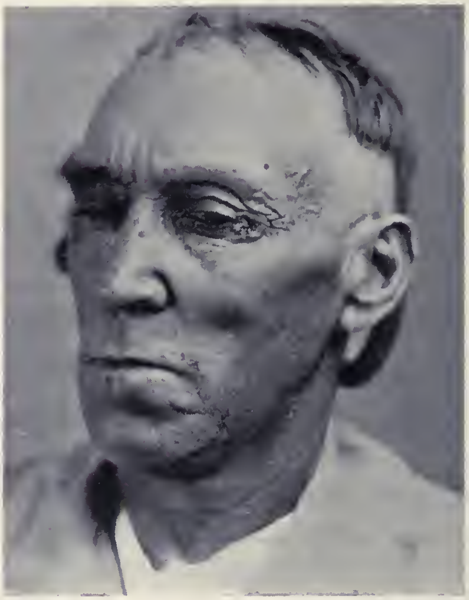

Fig. 714.—Photograph of patient showing ulcerating epithelioma of the outer canthus of the left eye.

He has had no treatment previous to entering the hospital, and therefore the lesion has probably not been handled much. This is important, as it is known that frequent handling of malignant growths increases the malignancy and frequently spreads cancer-cells along the lymphatic channels. The lesion is in this case situated at the outer canthus, measures about $\frac{1}{2}$ inch in diameter, and, unfortunately, has transgressed on to the upper and lower eyelids for almost $\frac{1}{8}$ inch. Luckily the conjunctiva has not become involved as yet, except for a very small area at the skin margin at the outer canthus.

This patient is being operated on under colonic anesthesia, which has been used with the greatest satisfaction at our hospital. There is no anesthetist with his apparatus to bother the surgeon and the operation can be done in comfort.

The cancer indications having been met, and the lesion radically excised by circular excision (Fig. 715), the problem of the reconstruction presents itself.

The eyelids, which have been cut across, are retracted markedly toward the nasal side by the contraction of the cut pars palpebralis of the orbicularis oculi muscles. They are brought back in place by taking a 00 catgut suture only through the muscle at the outer border of the cut lids and suturing them to the remaining outer portion of the junction of the tarsal and bulbar conjunctiva (Fig. 716). This will temporarily hold the eyelids in place and permit the closure of the tarsal conjunctiva with interrupted subconjunctival sutures. This closes the conjunctival sac again, narrowing the palpebral fissure, but permitting the flap repair to be entirely extraconjunctival. It is fortunate that not much of the conjunctiva was involved in the lesion, as the repair can be done without narrowing the palpebral fissure so much as to be inconvenient to the patient.

The problem of reconstruction is met by means of a flap plastic repair (Fig. 717). The pedicle is above, the flap being taken from the cheek, and the base of the pedicle is well above the line of the canthi. This is important, as the later contraction of the flap will tend to widen the palpebral fissure, which had been reduced in size, and the level of the base of the pedicle being above the level of the canthi there will be the desired upward pull of the flap. It will also avoid incising the flap at the outer canthus to widen the palpebral fissure which is a very disagreeable procedure to have to do, as the angular scar thus created at the outer canthus would cause rigidity, inability to close the eyelids, and a leakage of tears. The flap is sutured in place with interrupted fine black silk sutures (Fig. 718) and the remaining defect on the cheek from where the flap was

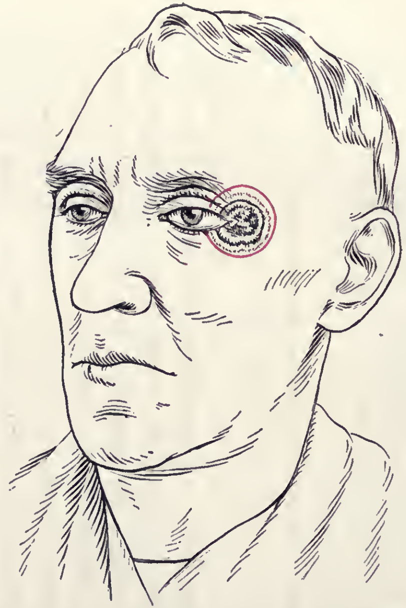

Fig. 715.—Diagram showing radical excision of the epithelioma, staying at a safe distance from the lateral borders.

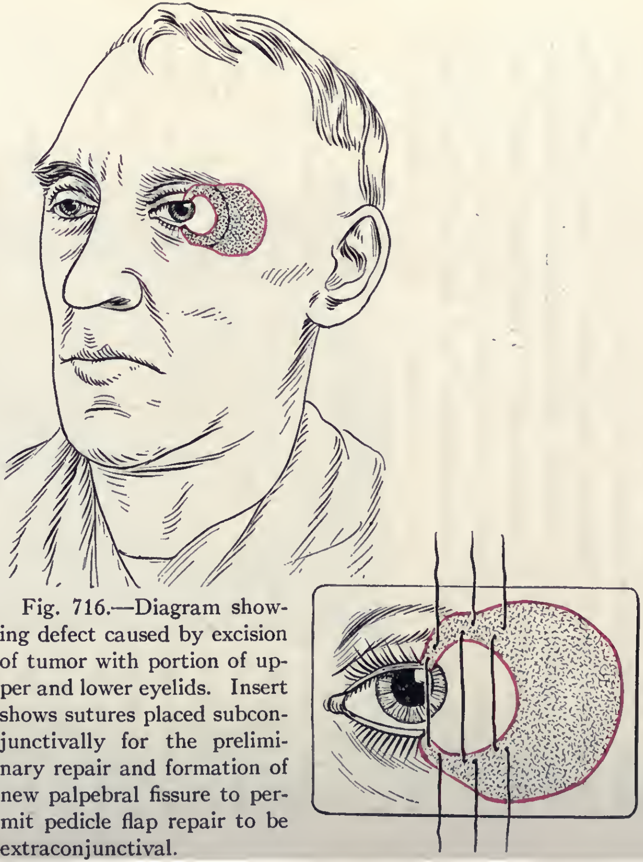

Fig. 716.—Diagram showing defect caused by excision of tumor with portion of upper and lower eyelids. Insert shows sutures placed subconjunctivally for the preliminary repair and formation of new palpebral fissure to permit pedicle flap repair to be extraconjunctival.

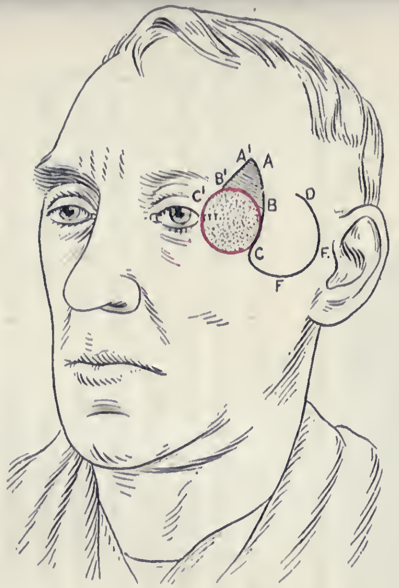

Fig. 717.—Diagram of pedicle flap repair from cheek with pedicle above the level of the canthi. Line *A–B–C* is equal to *A′–B′–C′*. Line *D–E–F* shows the larger curve of the flap to allow for the greater distance from point *D* to new-formed canthus. The shaded triangular area of skin must, of course, be excised to allow the flap to be swung into place.

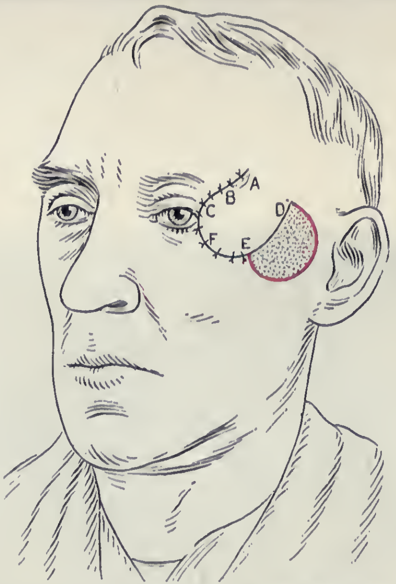

Fig. 718.—Diagram shows flap sutured in place with fine interrupted black silk sutures. The defect on the cheek is the area from which the flap was taken. Line *D–F* shows the line of incision just through the skin alone to relieve tension at point *D* without endangering the blood-supply to the flap by still further narrowing the pedicle by cutting through the entire thickness of the skin with subcutaneous tissue.

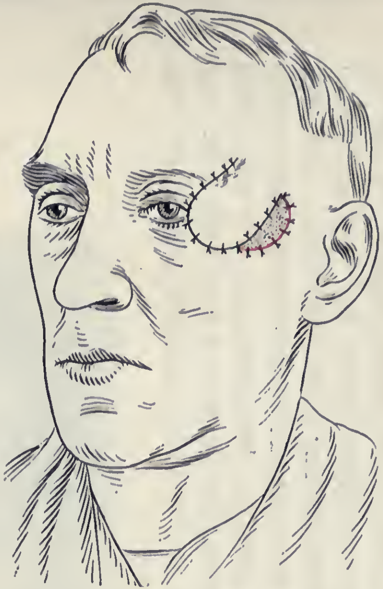

Fig. 719.—Diagram shows defect on cheek decreased in size by bringing wound edges together and suturing them to the underlying fascia. The defect is then ready to receive the Thiersch graft.

taken is reduced as much in size as safely possible by suturing the skin edge to the underlying fascia, and a small Thiersch graft is placed on the remaining defect (Fig. 719). This graft may be excised at the end of about four weeks, when the flap has become firmly adherent throughout, and the skin edges approximated by suture, leaving only a thin linear scar. The graft is dressed with silver foil and the suture line covered with wound shellac (Fig. 720).

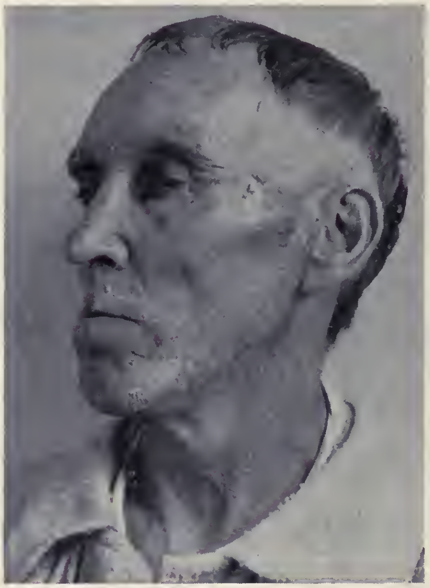

Fig. 720.—Photograph of patient two weeks after operation showing pedicle flap in place, with semilunar Thiersch graft covering defect in cheek.

All the fundamental cancer principles and indications have now been met in this case, and there is every reason to say that this patient will obtain a permanent cure of the epithelioma at the outer canthus of the eye (Fig. 721).

Case II.—This case has no especial clinical interest, since it presents merely a raw surface that requires covering with a skin-graft; but it affords an opportunity of discussing the question of Thiersch skin-grafting in some detail.

There are various methods of covering raw surfaces. One way is by means of Réverdin grafts. These are the so-called "pinch-grafts" in which small bits of epithelium are snipped off and transplanted to the raw surface. This type is used to advantage when the raw surface is infected and there is much secretion. In using these grafts the danger of their floating away is partially eliminated. The second variety are the Wolfe or Girdner grafts. These are small bits of grafts similar to the Réverdin grafts, but the entire thickness of the skin is used. In this it is important to carefully trim off all the fat from the under surface of the graft. This point was especially brought out by Krause, who described the use of grafts similar to the Wolfe grafts, but much larger in size. Finally, Thiersch described the use of "graft shavings" of large size, using only the outer layers

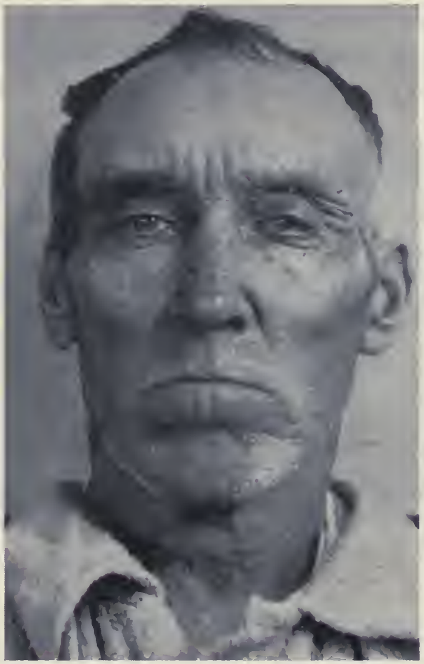

Fig. 721.—Photograph of patient two weeks after operation showing narrowing of palpebral fissure.

of epithelium similar to Réverdin. And lastly, there is the repair by pedicle flaps.

The raw surface must be dry and as sterile as possible. It may either be of very recent origin or it may be an older granulating wound. If the latter, the character of the granulations for receiving the graft can be determined by putting on some gauze and making a little pressure. If the gauze, when carefully rolled off, leaves its imprint on the granulations, then it is safe to assume that the transplanted grafts will hold and take. But if the imprint does not stay on the granulations, then they must be shaved off with a scalpel and pressure made with gauze to control and stop the oozing. It is well in these cases if possible to prepare the granulations the night before it is intended to graft. If there be much infection, iodoform gauze is best used for this purpose. When the raw surface is such as remains after the excision of a crural ulcer, artificial anemia must be obtained by applying an Esmarch bandage at the thigh, or a Sehrt metal tourniquet, and leaving it in place for three to four hours. This can be done with safety, but the patient requires a big dose of morphin. After the compression around the thigh has been removed, digital compression of the femoral artery at the pubic bone takes its place. It is slowly relaxed and the blood allowed to enter the field step by step.

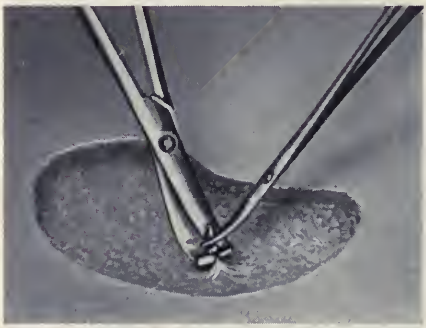

Fig. 722.—Diagram to show use of Blunk angiotribe to crush vessel, caught first by a Halsted mosquito clamp. This technic does away with the ligature knot under a Thiersch graft in certain cases.

When the raw surface is of very recent origin, as following excision of a tumor or the defect caused by pedicle flap plastic, etc., then hemostasis is obtained by careful ligation of all bleeding vessels and pressure with a hot compress. If the area is in a region easily seen, as in the face, and the raised knot of the ligature would be unpleasant under the Thiersch graft, causing an irregular, raised surface, then this may be overcome in some cases by clamping the vessel with a mosquito (Halsted) clamp and crushing the vessel on the tissue side of the clamp with a Blunk angiotribe (Fig. 722). This instrument is best used without the automatic catch (Fig. 723).

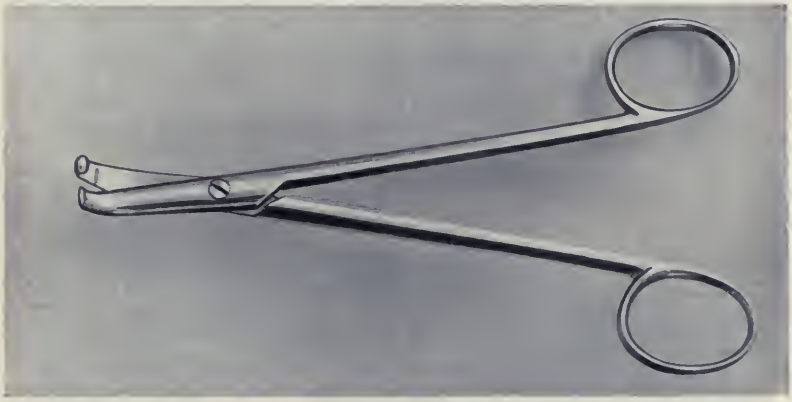

Fig. 723.—Blunk angiotribe.

Besides good hemostasis the raw surface in recent wounds can usually be greatly reduced in size by undercutting the skin edges and drawing them together as much as possible and then suturing the skin edge to the underlying fascia. With the knots of the sutures on the skin side the sutures are left long and caught with a hemostat so as to be out of the way during the placing of the graft.

If possible, the outer anterior region of the thigh is used to take the graft from, at a level a little above the patella upward. This has been shaved and is cleansed with alcohol and ether. When the patient is not under a general anesthetic the best

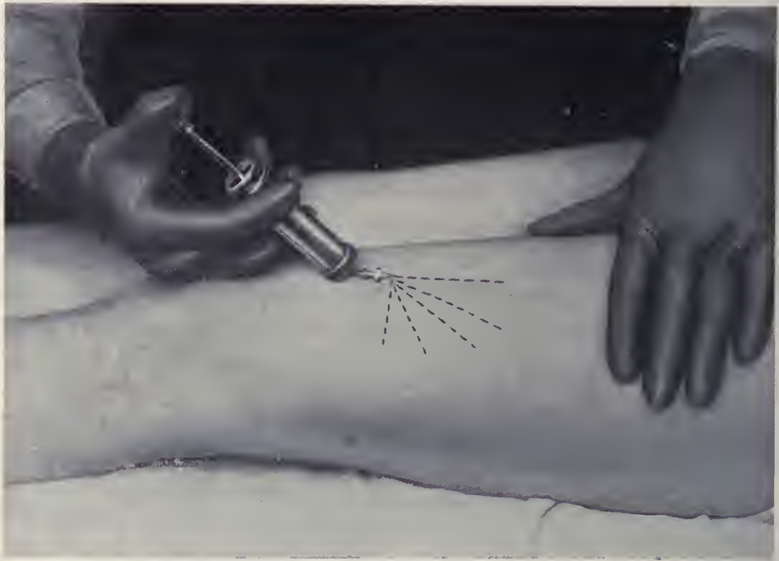

Fig. 724.—Shows how novocain infiltration of thigh may be done through one needle puncture with long needle in fan-shaped fashion.

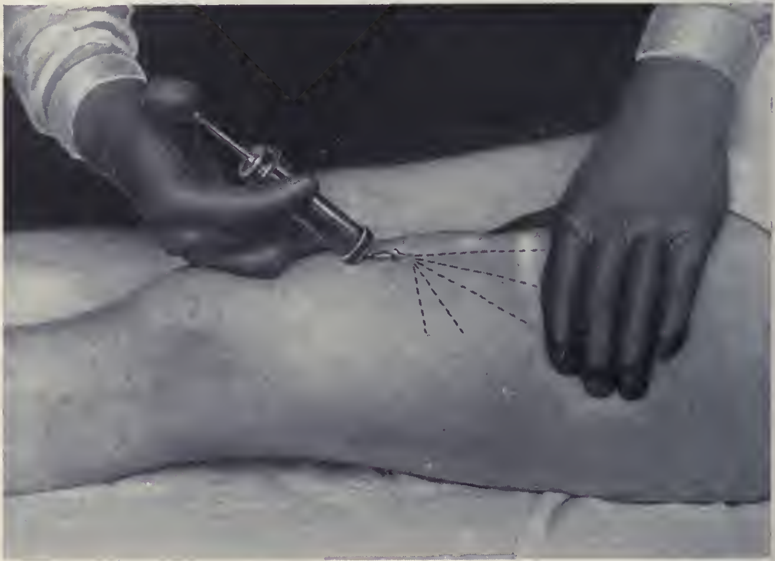

Fig. 725.—Indicates how a still greater area may be infiltrated by pushing the tissues on to the already totally submerged needle with the left hand.

means of anesthetizing the area is by subcutaneous injection of ½ per cent. novocain solution. This is easily done through one needle puncture in fan-shaped fashion as shown in Fig. 724. A still larger area can be infiltrated through this same puncture by pushing the tissues with the left hand on to the already totally submerged needle (Fig. 725). The best syringe for this purpose is the Record syringe with bent tip and bayonet attachment for the needle (Fig. 726). The outer four corners of the area infiltrated are touched with a wipe, moistened with tincture of iodin, so as to mark the outer boundaries of the anesthetized area.

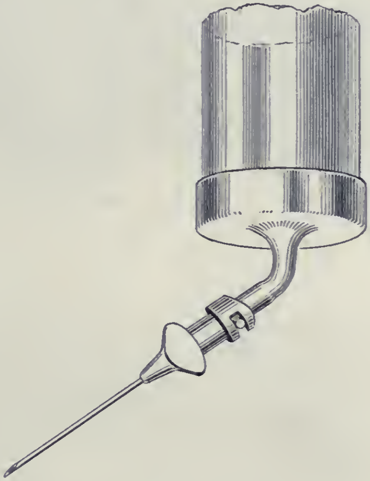

Fig. 726.—Record syringe with bent tip and bayonet lock for needle used for novocain infiltration.

In cutting the graft it will be found to be very much easier to always cut from below upward (against the grain of the skin) than from above downward, as the majority of surgeons are accustomed to doing. This procedure, especially in some women and children with thin skin, prevents the annoying buckling of the skin (Fig. 727). The assistant must make very strong downward traction with his hand while the surgeon makes traction upward with his left hand. If this is done with the flat of the hand, which must be dry, the skin will flatten out nicely and a good wide graft may be cut. If the thigh is very thin, a second assistant can push the soft parts from behind the thigh forward and thus obtain a wider surface from which to cut the graft. If the graft is to taper to a narrower point, more triangular in shape, then, as it is being cut by the to-and-fro motion of the razor in the right hand, the left hand of the surgeon which makes the traction upward with the flat of the hand must slowly be curved (Fig. 728), thereby making a greater convexity of the skin of the thigh, and the graft will automatically shape itself.

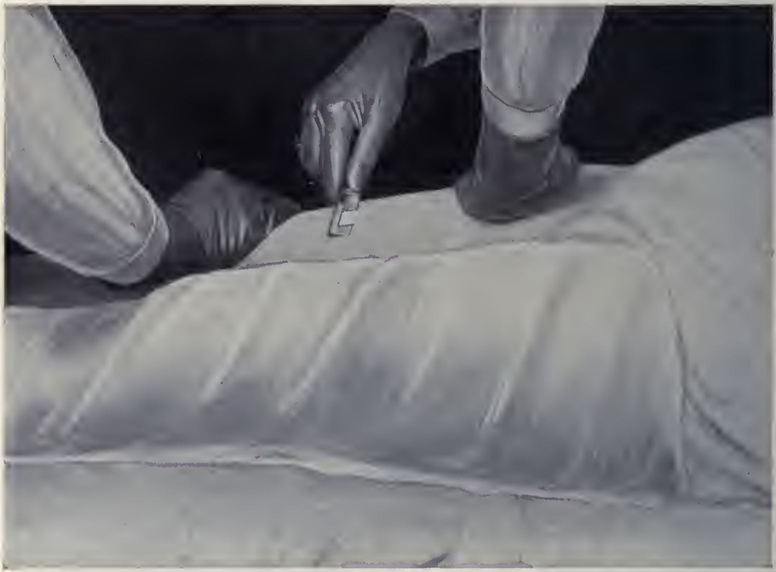

Fig. 727.—Indicates how the Thiersch graft is cut from *below upward*, the assistant making strong traction downward toward the knee, while the surgeon makes traction upward with his left hand.

Many mechanical means have been devised in the form of instruments to make this tension of the skin, such as the grafting skin hooks of McBurney, and lately T. P. Kilner and T. Jackson in their article on Thiersch Skin-grafting in the Buccal Cavity (British Journal of Surgery, July, 1921) advise the use of an instrument for skin fixation in cutting a graft when alone without the aid of an assistant (Fig. 729). We have not employed this instrument and therefore cannot state its merits from experience with its use. After all, the two hands, one of the assistant, and the other of the surgeon, are the *very* best means of fulfilling all requirements and conditions for putting the skin on stretch.

The field from which the graft is cut must be dry. The razor alone is moistened with saline, and as soon as the graft has been cut the razor must be wiped dry so as to avoid NaCl corrosion of the edge. The small epithelial shreds are wiped off before the graft is transplanted on to the raw surface.

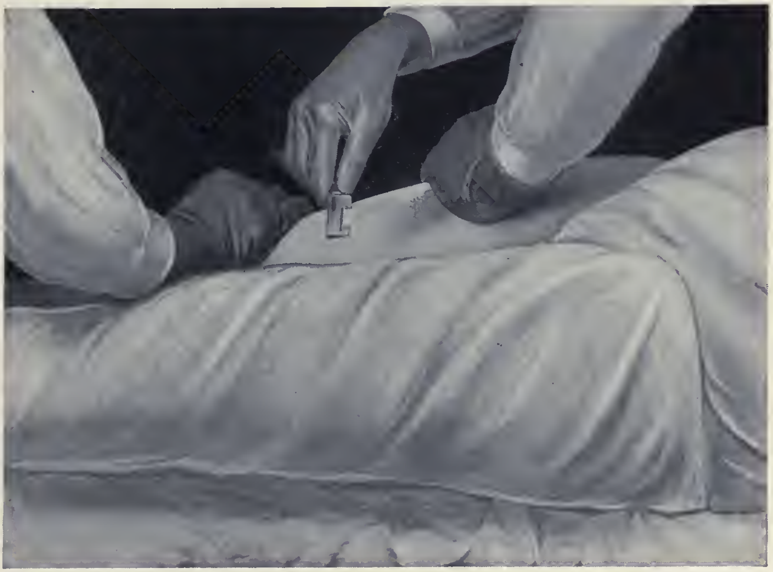

Fig. 728.—Shows how Thiersch graft shapes itself into a triangular-shaped graft, while being cut, by the surgeon curving his left hand as he slides over the skin while making traction upward, thereby causing the thigh to take on a greater convexity, and naturally a narrower surface from which the graft is being cut.

In 1907 Max Hoffmann, of von Hacker's Clinic in Graz, Austria, published a grafting razor, constructed by him, which can be automatically set to cut grafts of a definite and equal thickness, depending on how close the rounded cross-bar is set above the edge of the razor. The width of the graft cut depends on the amount of pressure made on the skin by the rounded bar which flattens the skin out and allows the graft of a certain thickness to be cut even though marked pressure is made with the razor. As the razor blade is sharpened and becomes narrower with use the bar can be adjusted to always be the same distance away from the front edge of the blade. It is an ingenious instrument and easily handled. It was described in the Centralblatt für Chirurgie, vol. 1907, p. 318 (Fig. 730).

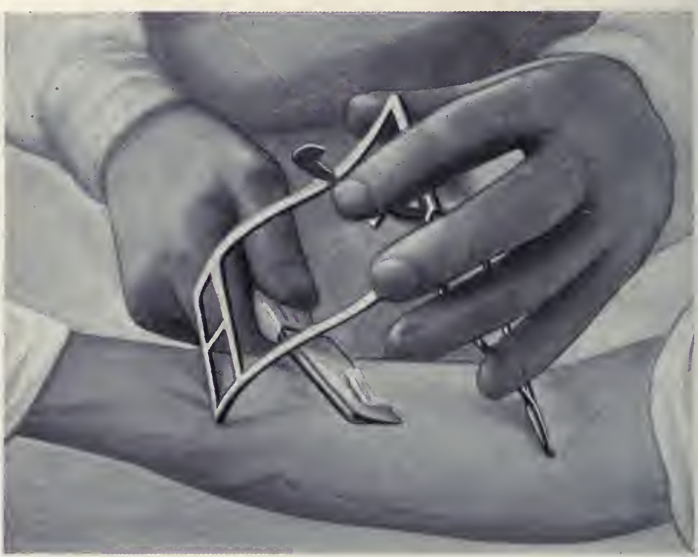

Fig. 729.—Automatic skin fixation instrument used in cutting graft without assistance as devised by T. P. Kilner and T. Jackson. (Taken from British Journal of Surgery, p. 153, July, 1921.)

The graft having been cut, the thigh is temporarily covered with moist gauze and the graft transferred from the razor directly to the raw surface. In some cases it is convenient and wise to first smooth out the graft on a grafting spoon (Fig. 731), from which it can be easily transferred to the raw surface by just holding the graft fixed with a probe and sliding the spoon out from under it (Fig. 732). Usually, however, it is easiest to transfer the graft directly from the razor. The raw surface of the graft may be distinguished from the external surface of the graft by its shiny appearance. Once on the denuded surface, the graft must be smoothed out. This is done by fixing it with the ball end of a probe and smoothing out the edges with the flat end of another probe. Air-bubbles can best be expelled by

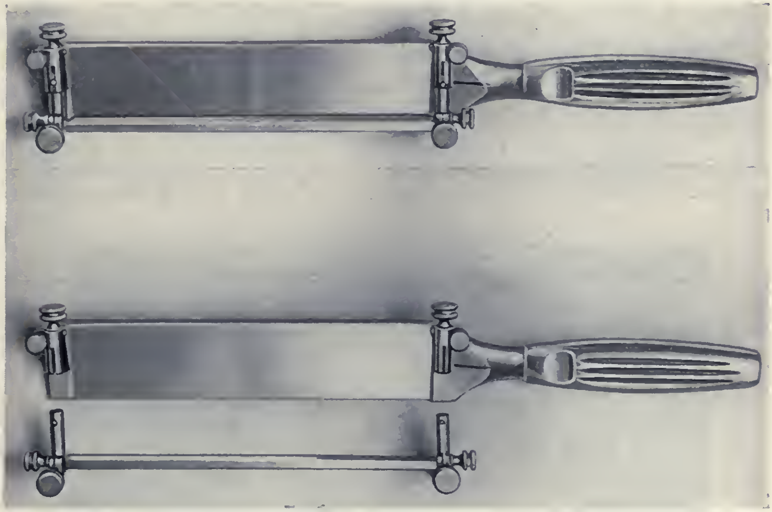

Fig. 730.—Hoffmann's automatic grafting razor. The smooth rounded bar, shown separately, is the adjustable porton of the razor. The two pairs of set-screws regulate its distance from the razor edge. One set adjusts the distance above the razor edge to regulate the thickness of the graft, while the other adjusts the distance in front of the edge to allow for narrowing of the blade after sharpening.

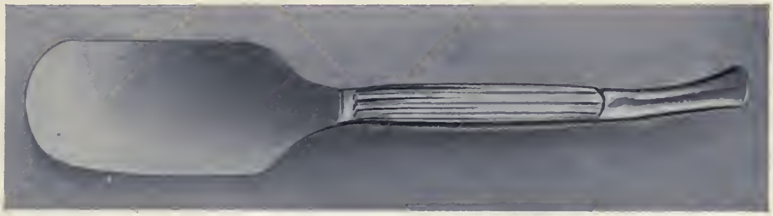

Fig. 731.—Grafting spoon on which graft may be smoothed out before transferring it to raw surface. These may be had in various sizes.

making pressure over the graft with a moist gauze compress. Being moist it will not adhere to the graft or dislodge it. Instruments with which the graft must be handled or trimmed must be moistened with saline or else the graft will adhere to them.

The graft should not always be placed directly up to the edge of the defect. This is especially the case when the surrounding border is raised. A little alley-way at the border allows oozing to escape without lifting the graft up and dislodging it. It also gives a smoother scar by pulling the raised edges down and prevents the circular contraction of the edge which takes place when the graft is laid directly up to the border. This contraction is annoying, as it causes an overhanging of the circular contraction ring onto the flat graft in the middle of the defect. It is most important to avoid defects between the edges of separate grafts as the graft at any rate has to fight for its existence, and therefore reproduction is in abeyance. If a defect is present between grafts granulations spring up rapidly and it then sometimes takes from five to six weeks before these granulations will be covered with epithelium. Therefore any defect should be at the edge of the wound where the normal epithelium from the skin can advance to meet the graft.

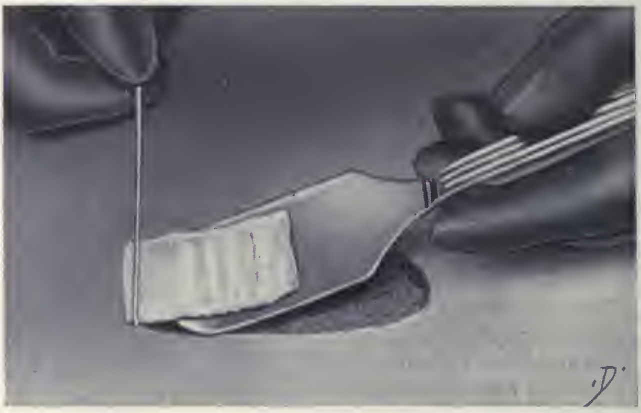

Fig. 732.—Diagram showing how the graft may be placed on defect by just sliding spoon from under graft.

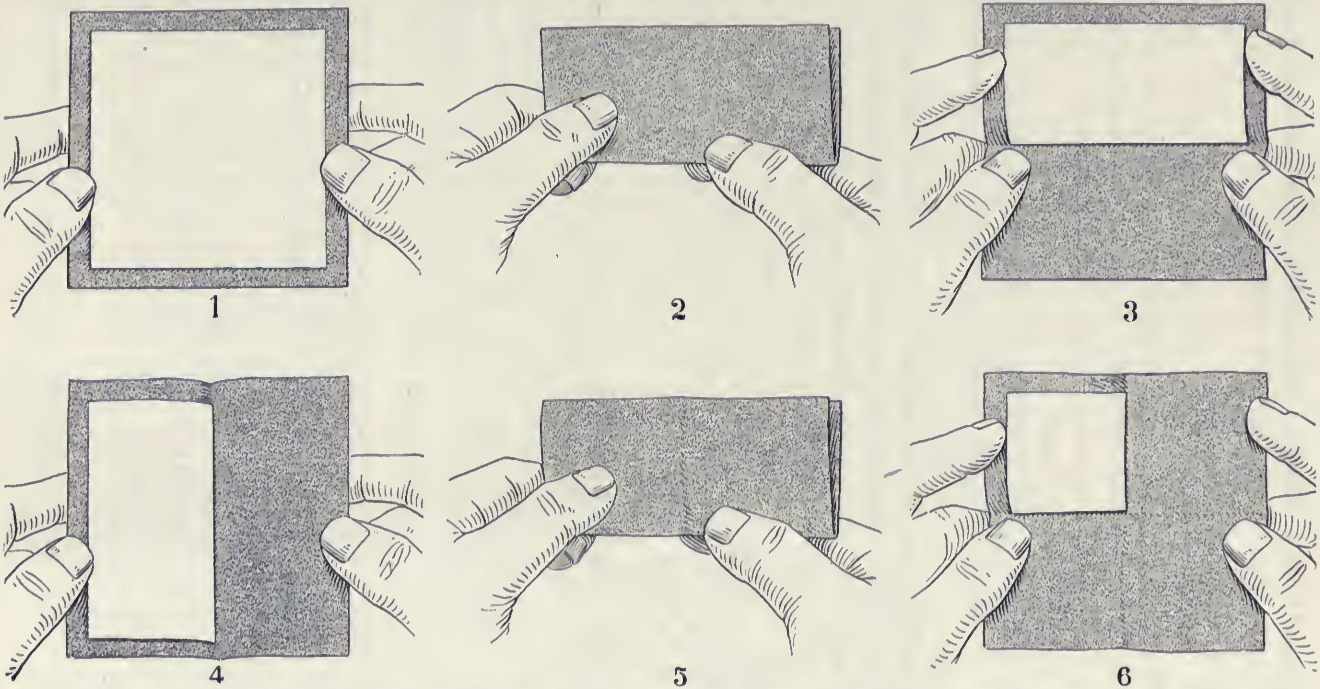

Fig. 733.—Diagram to show how the silver foil may be folded into any shape desired by folding the paper, with the foil on it, over on itself. The paper alone is then opened up completely before folding it into the next shape desired.

If there is much oozing of blood a little wider alley-way must be left and a thin narrow layer of iodoform gauze laid over this alley-way.

The best dressing for these skin-grafts is the sterile silver foil. It forms a mechanical covering for the graft which, however, is so fragile that it will easily break and allow secretions to escape. The oxychlorids or oxids of the silver also have antiseptic properties and hinder the growth of bacteria. The graft is covered with from 5 to 7 layers of the silver foil, while the wound on the thigh is covered with 10 to 14 layers of the foil. The operation being practically completed, the surgeon's gloves may be removed and the hands thoroughly dried. With bare, but dry hands it is much easier to prepare and place the silver foil on the wound. Any slight moisture on the hands will make the foil adhere and cause no end of trouble and annoyance. The foil can easily be folded while still on the small paper squares into any shape and size desired by folding the paper over on to itself and thereby also the foil (Fig. 733). The only trick to remember is to completely open up the small paper before folding the foil anew.

The foil is covered with a thin layer of sterile gauze and this is firmly fixed with sterile zinc adhesive plaster, not merely with transverse strips but also oblique ones, and over this the ordinary picture-frame strips are placed. If the black silk sutures used to decrease the size of the raw surface were left long they may be used to hold the dressing in place by tying them across the foil and gauze dressing.

One word about the after-treatment. The dressing on the grafted area is left in place for five to seven days, when it is dressed with a bland bismuth and zinc oxid ointment. Later, if there are any areas not completely closed, a 1 per cent. fuchsin (Merck) ointment will best stimulate the growth of epithelium. The dressing on the thigh is left undisturbed for fourteen days, when it may be removed and the wound found completely healed.

CLINIC OF DR. SEWARD ERDMAN

New York Hospital

HIGH ENTEROSTOMY FOR RELIEF OF ILEUS COMPLICATING APPENDICITIS[1]

Jejunostomy the Choice for Relief of Ileus Complicating Appendicitis, Whether Mechanical or Paralytic. Presentation of Three Cases. Indications. Results. Technic of Procedure. Inefficiency of Other Methods.

Today I am confronted with the very unusual necessity of operating upon 2 cases of ileus complicating peritonitis from acute appendicitis, and afterward I will show you a third case, from the same ward, a man who is now convalescent.

Case I.—Jejunostomy for ileus on the third day after appendectomy for ruptured gangrenous appendix, with spreading peritonitis.

This patient, a Greek waiter, aged thirty-four years, presents, as you see, the picture of an advanced general peritonitis and is a desperately sick man.

The slender facies are pinched and drawn, the lips and tongue are desiccated, the breath foul and feculent in odor.

Vomiting has been persistent for over twenty-four hours and colon irrigations return without gas or feces.

The vomiting or, rather, "spitting" is really a regurgitation, and issues from the mouth without any effort at forcible vomiting.

The vomitus consists of small amounts of yellowish-brown fluid, with a disagreeable odor, but it can hardly be termed fecal, although it appears definitely to be intestinal in origin.

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[1] These cases are reported by courtesy of Dr. E. H. Pool, Chief of Service, Second Surgical Division, New York Hospital.

The skin is moist, the hands cold and clammy.

The temperature is 102° F. and the pulse is small, thready, and 144 per minute.

The abdomen is distended, tympanitic, but not rigid.

The open wound of the appendectomy is discharging a colon odored brownish pus.

History.—On October 6, 1921 he began to have steady colicky pain in the lower abdomen, with nausea, but no vomiting. The pain became localized over the appendix and has been persistent. The bowels moved on the second and third days, but not since. On the third day dysuria supervened.

On October 10, 1921 he was admitted to the New York Hospital with a temperature of 102° F.; leukocytes 16,000, 88 per cent. polynuclears. At this time he presented rigidity of the right lower abdomen, with marked rebound tenderness over the entire abdomen.

A small mass was palpable in the region of the appendix.

Operation was at once performed by one of the surgical staff, and a completely gangrenous appendix, surrounded by 2 ounces of pus with the odor of colon bacillus, was found and the appendix removed. The peritoneum of the surrounding intestines was seen to be acutely inflamed. Two cigarette drains.

For two days following this operation the temperature remained elevated and the pulse became more rapid.

Abdominal distention became constantly more marked, and for the past thirty hours there has been vomiting at frequent intervals despite several lavages of the stomach.

Until this morning there had been no passage of gas or feces from the rectum, but this morning, after a colon irrigation combined with the administration of pituitrin, a small amount of gas and feces was obtained.

Directly after this the distention recurred and the vomiting has been incessant.

Today, the seventh day of illness and the third after operation, the man is almost *in extremis*, with a pulse of 144.

Indications.—Realizing that this man has undoubtedly a general septic peritonitis, we are, nevertheless, face to face with the symptoms of ileus, locking of the bowels, distention, and intestinal vomiting.

Whether the ileus is due only to paralysis or is mechanical, or both, I believe it is impossible to distinguish.

Certainly the distressing vomiting and the distention demand relief if possible, and we shall perform a high enterostomy as a "dernier ressort" in the attempt to drain the toxic material within the intestine, the absorption of which is but adding to the toxemia due to the peritonitis.

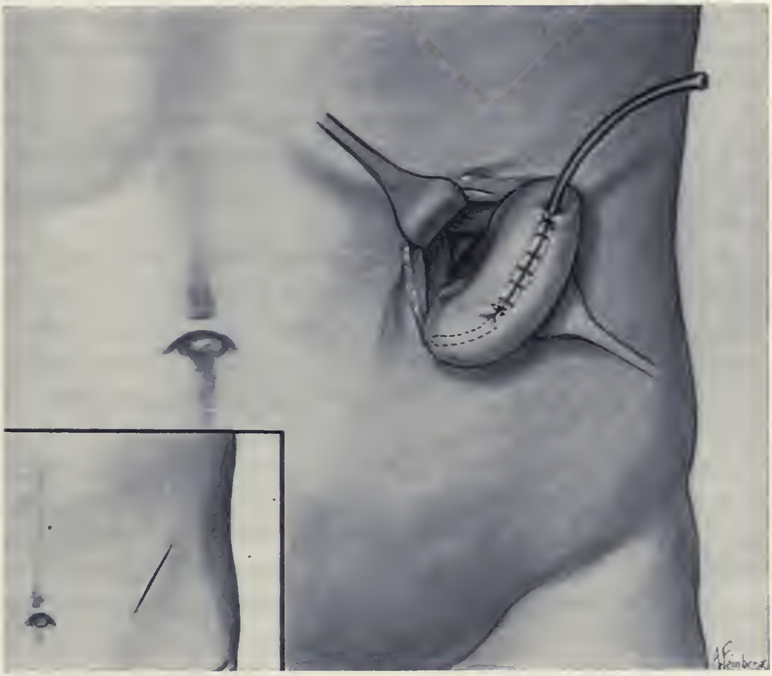

Fig. 734.—High enterostomy, through intermuscular incision, at outer border of left rectus.

Preparation.—Gastric lavage is always to be performed immediately before any operation for intestinal obstruction, and has been so performed in this case. Numerous cases have died on the operating table from neglect of this precaution.

The aspiration of vomitus under a general anesthetic simply drowns the patient.

We do not intend to use a general anesthetic, but the lavage will render safer the addition of a general anesthetic if our local anesthesia proves unsatisfactory.

Anesthetic.—Local anesthesia with 1 per cent. novocain is to be preferred.

Technic of High Enterostomy.—An oblique intermuscular incision is made in the left side of the abdomen just lateral to the left rectus and a little above the level of the umbilicus.

Upon opening the peritoneum I encounter a turbid free fluid from which a culture is taken. (Later reported colon bacillus.) The intestines are distended and very red, but no lymph is seen.

Without trauma or unnecessary handling a short loop of distended intestine is drawn out of the incision.

On the convex surface a circular purse-string chromic suture is placed, the intestine opened with the thrust of a scalpel, a No. 20 French catheter rapidly introduced for 3 inches, and the purse-string suture at once tied snugly.

The end of the catheter has been previously cut off, and a lateral opening made in it near the tip.

The tube is now depressed along the convex surface of the bowel, thus lying in a furrow, and the edges of the furrow are sutured together over the tube for a longitudinal distance of 1½ inches, after the Witzel method of gastrostomy.

The intestine is now returned to the peritoneal cavity and sutured lightly to the peritoneum. The wound is not sutured, but the tube is fastened to a skin edge with silk.

A small rubber-dam drain is placed down to the peritoneum.

You see that we have obtained almost at once a gush of about 10 ounces of fluid intestinal contents through our tube, and of the same character as the vomitus.

Appended History of Case I.—Only small amounts of drainage were obtained in this case. The vomiting and distention were somewhat mitigated, but not entirely relieved, and the man died eighteen hours later. No autopsy could be made.

Remarks.—It is possible that earlier enterostomy might have been of greater benefit.

Case II.—The next case for operation is Joseph S., aged eight years, who was admitted to the New York Hospital on October 4, 1921 suffering from acute suppurative appendicitis with spreading peritonitis, the illness being then of four days' duration.

History.—One previous similar attack four months ago.

On October 1, 1921 he was seized with general abdominal pain, becoming limited to the right lower quadrant.

There was vomiting with the onset, and on the third and fourth days he complained of difficulty in urination.

On admission to the hospital the temperature was 103° F., the leukocytes 16,000, with 90 per cent. polynuclears.

On October 4th at operation, which was performed immediately, a suppurative appendix was removed. The appendix lay surrounded by several ounces of purulent fluid (culture showed colon bacillus); its tip lay over the brim of the pelvis and to the left of the midline. There was practically no attempt at walling off and a spreading peritonitis was recognized.

Drain. Rubber-dam Mikulicz drain. Wound not sutured.

Following this operation the boy did not do well; the abdomen became distended and each day he vomited several times.

Colon irrigations and catharsis alike failed to obtain satisfactory returns.

On the seventh postoperative day a pocket of pus, which had been felt by rectum, was opened into and drained through the appendix wound, and about 3 ounces of pus evacuated from deep in the pelvis.

For the past forty-eight hours, however, the distention has become more marked, the vomiting has become persistent, and there has been no passage of gas or feces.

The vomitus has become feculent in character.

Present status October 13th, the thirteenth day of illness and the ninth day after appendectomy: You see an undersized, wasted little boy who appears very ill. The lips are dry and covered with sordes, the cheeks are sunken; the tongue desiccated and the breath foul. He is vomiting small amounts of dark brown watery fluid. The abdomen is very distended and tender over all. The appendix wound is draining a foul-smelling pus.

Indications.—The whole course of the case points to a general peritonitis with a supervening ileus.

In this case the ileus may be suspected of having a mechanical origin, in view of the matting of the intestines about the drained abscess in pelvis; on the other hand, it may be purely paralytic.

In either case a high enterostomy seems definitely indicated.

Procedure.—1. Lavage has just been performed in an adjacent room.

2. Anesthetic. On account of the youth and lack of coöperation of the patient we are here using ether by the open method instead of a local anesthetic.

3. We make a 1¾-inch intermuscular incision 3 inches to the left of the midline and just above the level of the umbilicus.

As we open the peritoneum a small amount of turbid serum escapes, and the reddened, distended loops of intestine are flecked with plaques of lymph, indicating the generalized character of the peritonitis.

A distended loop of intestine is delivered and a jejunostomy performed as above described, using in this case a No. 18 French catheter, with the end cut away.

The returned bowel is sutured to the peritoneum, the tube sutured to the skin, and the wound left open.

There has been a minimum of trauma and exposure of the bowel, the whole operation has taken less than ten minutes; very little ether has been necessary and there should be no appreciable shock to the patient.

While the dressings are being applied you see that we have already collected more than 10 ounces of brown intestinal fluid similar to the recent vomitus.

Appended History of Case II.—The enterostomy tube drained very satisfactorily into a bottle beside the bed for four days, yielding 20, 16, 10, and 6 ounces respectively.

The vomiting never recurred after operation, and the distention was rapidly and markedly relieved.

On the fourth day gas and feces passed by rectum, the tube was removed; there was slight leakage for five days, after which the wound closed.

General improvement was immediate and the boy was discharged cured on November 9, 1921.

Case III.—Appendix abscess, ruptured. Spreading peritonitis. Ileus. High enterostomy. Recovery.

We wish to show you a third case of high enterostomy, one which is now convalescent in our wards.

History.—K. E. A., a Swedish barber aged sixty years, was admitted to the New York Hospital on September 23, 1921 with symptoms of intestinal obstruction, complicating ruptured appendix abscess.

For two weeks he had been sick in bed at home. The onset was with general abdominal pain, nausea, and diarrhea.

After the first day the pain became localized in the right lower quadrant and remained there for six days.

Five days before admission to the hospital, although the local pain was less and he had not vomited since the second day of the attack, the vomiting returned, and has been persistent up to the present.

His physician says that the vomitus has become definitely fecal and for the past thirty-six hours he has passed no gas or feces.

Condition on Admission.—An elderly, poorly nourished man, markedly prostrated, appearing so desperately ill that he seems almost moribund.

Lips and skin dry, tongue heavily coated, dry; breath of foul, fecaloid odor. Vomitus of fecal character.

The respirations were rapid, labored, and shallow.

The pulse was feeble and thready.

The abdomen was much distended and rigid, with general tenderness maximum in the right lower quadrant.

His physician reported that several days ago there had been palpable a mass in the appendix region, but at present the tenderness and rigidity entirely masked palpation.

The temperature was 102° F. The leukocytes 27,000; 88 per cent. polynuclears.

Indications.—The outstanding feature in this case, as I saw the man on admission, was the ileus, which urgently demanded relief.

Procedure.—1. Gastric lavage returned, with a large amount of fecal smelling brown fluid.

2. Anesthesia. To shorten the time consumed in making two incisions gas-oxygen anesthesia was administered.

3. (*a*) An intermuscular incision was made over the appendix and an abscess about the cecum containing 2 ounces of thick, creamy, odorless pus was evacuated.

The appendix was not palpable and was not sought for.

A large rubber-dam Mikulicz tampon drain was inserted and the wound left open.

(*b*) Recognizing the serious import of the ileus, whether paralytic or mechanical, an immediate enterostomy seemed indicated, in addition to draining the appendix abscess.

Accordingly, an intermuscular incision was made 4 inches to the left of the umbilicus and a high enterostomy performed with the usual technic, using a tube the size of a No. 18 French catheter. The wound was left without suture.

In this left upper quadrant there was free turbid fluid and the distended intestines were very red.

4. The entire procedure occupied twenty minutes. Before leaving the operating table more than 700 c.c. of foul-smelling fluid feces and considerable flatus were expelled through the tube.

Postoperative Notes.—For three days there was profuse drainage, averaging about 1500 c.c. per day.

On the second day and for four days thereafter there were small involuntary liquid stools.

The tube was removed on the fourth day, after which there was scarcely any drainage, for the valve action of the enterostomy opening came into play and the wound healed very promptly.

After the operation the distention was at once relieved and there was absolutely no recurrence of the vomiting.

The convalescence has been rapid despite a fecal fistula in the appendix wound, which discharged from the fourth to the seventeenth day.

Addenda.—This third case was discharged on October 18, 1921.

HIGH ENTEROSTOMY

Neither this method nor any other will save all cases, but as a valuable and efficient method of bowel drainage it has much to be said for it.

Credit for the idea of "high" as opposed to "low" enterostomy belongs to Victor Bonney, of the Middlesex Hospital in London, who proposed the high enterostomy for intestinal obstruction in 1910.

For more than half a century the practice of enterostomy has usually followed the suggestions of Nélaton, that through a right lower quadrant incision the "first coil of distended intestine which presents" should be sutured in the wound and opened. In effect this usually drained the lower ileum.

In our own experience, and we believe in the experience of surgeons generally, the results have been far from satisfactory; not alone that the mortality has remained so high (for this will doubtless always remain high in the advanced peritonitic cases), but especially in that the attempted drainage so often failed to drain.

Following a low enterostomy one is accustomed to witness the exit of a considerable amount of flatus, and but very little or no fluid material.

There is collapse of the immediate segment of the bowel, but failure to relieve the general distention or to stop the vomiting.

In too many cases there is practically no further drainage of gas or feces, and one feels that little has been accomplished.

Recognizing the inefficiency of low drainage, other more drastic measures have been recommended, such as the exposure of multiple loops of intestine and the performance of multiple punctures or enterostomies, or the insertion of a rather stiff rubber tube which is threaded way up or down the bowel, by hauling the intestine on to the tube.

This sounds like a very shocking procedure, involving the extensive handling of the intestines, and it is difficult to conceive of a desperately ill patient withstanding the operation.

Rationale of High Enterostomy.—Bonney divided the intestine of obstruction cases into three segments:

(*a*) The lower segment, more or less collapsed, which, however, often contains some gas.

(*b*) The middle, containing gas.

(*c*) The upper, containing fluid and representing the "zone of toxicity."

As soon as feculent or intestinal vomitus appears it shows that the upper fluid segment has reached the stomach, and therefore a jejunostomy will efficiently tap the toxic fluid level.

The peristalsis has become reversed, and Bonney explains the toxicity by asserting that "this upward extension of the limits of the fluid-containing segment is due to a rapid upwardly extending infection of the canal by organisms of the lower intestine."

Certainly toxic absorption from the mucosa must play a large part in the mortality from intestinal obstruction, and drainage of this fluid is a great desideratum.

Conclusions.—From a limited experience I feel confident that much more efficient drainage of the toxic intestinal contents can be obtained by a "high enterostomy" than by a "low enterostomy."

The relief of vomiting and distention is greater after a jejunostomy than after a low ileostomy.

It is performed rapidly, with a minimum of trauma, under a local anesthetic, and should cause no appreciable shock.

The valve-like action of a properly performed jejunostomy results in automatic closure of the opening as soon as the tube is removed, and no secondary operation for closure is necessary.

After primary relief of obstruction the tube may be used for the ingestion of fluids.

There is no panacea for intestinal obstruction, but a "high enterostomy" is deserving of a very thorough trial.

VARIX IN SCARPA'S TRIANGLE SIMULATING FEMORAL HERNIA[1]

Varix in Scarpa's Triangle. Symptoms. Physical Signs. Differential Diagnosis. Treatment.

THIS morning we are about to operate upon a patient who was referred to the hospital with the diagnosis of femoral hernia. Certain features in this case have raised in our minds doubt as to the correctness of the "hernia" diagnosis, and have led us to the diagnosis of varix of the internal saphenous vein in Scarpa's triangle.

Case I.—The patient, Cecilia W., is a young Austrian woman aged twenty-three years, a bookkeeper by occupation.

She was referred to the New York Hospital on May 13, 1921 with the diagnosis of femoral hernia.

Chief Complaint.—A swelling in the right groin.

Present Illness.—About two months ago she casually noticed a swelling in the right groin, which has been slowly increasing in size, but which is not painful or tender.

Past History.—For ten years she has had moderately varicose veins in both legs below the knees, which have not given rise to symptoms.

For two years there has been some gastric indigestion associated with marked constipation.

There is no history of typhoid or any other serious illness.

The menstrual history is normal. No pregnancies.

Examination.—Just below the fold of the right groin there is visible and palpable a swelling or bulge about 1 inch in diameter. This is very prominent on standing and disappears on lying down. It is felt as a soft, almost gaseous, rounded mass, just lateral to the spine of the pubis and below Poupart's ligament.

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[1] These cases are reported by courtesy of Dr. E. H. Pool, Chief of Service, Second Surgical Division, New York Hospital.

Through the overlying skin there is noted a faint bluish tinge.

There is definite expansile impulse on coughing, but no contents are palpable.

Although readily reducible by light pressure, it rapidly reappears.

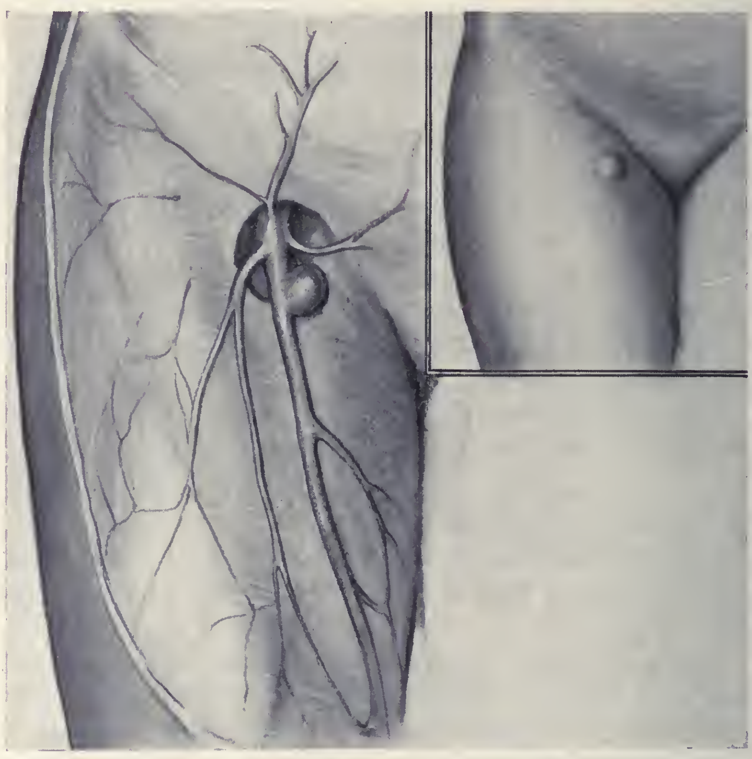

Fig. 735.—Varix of saphenous vein in Scarpa's triangle, simulating femoral hernia.

Operation.—We make an oblique incision below and parallel to Poupart's ligament, and as we divide the subcutaneous tissues we expose to view a rounded bluish mass, 1 inch in diameter, situated superficial to the deep fascia and close to the saphenous opening.

Careful dissection shows this to be a thin-walled varix, arising from the internal saphenous vein just before its junction with the femoral vein.

The shape of the varix is similar to a saccular aneurysm and is not a fusiform expansion of the whole vein.

We now proceed to excise the varix together with 1½ inches of the sapenous vein after the application of ligatures above and below.

Two other similar cases have been operated upon by me in the past year, and I will present them at this time.

Case II.—Elizabeth B., an Irish woman aged forty, was in the New York Hospital from January 5 to 15, 1920, having been referred with the diagnosis of femoral hernia.

Chief Complaint.—Swelling in the right groin of seven weeks' duration.

Present Illness.—About seven weeks ago while bathing she noticed for the first time a swelling in the right groin, and she says that this has increased in size. It is not painful and it disappears upon lying down.

Past History.—Patient attributes the appearance of this swelling to heavy lifting in the course of her housework.

There is no history of serious or chronic illness, except that for some years the veins of both legs have been somewhat enlarged, but have caused no discomfort.

Physical examination of the local condition showed a small swelling just below Poupart's ligament on the right side, which was soft, compressible, and not tender.

There was expansile impulse on coughing, and at the same time a peculiar thrill, the direction of which was hard to determine.

The femoral ring did not feel enlarged. The skin over the swelling showed no change in appearance.

Both legs show slightly varicose veins.

Operation.—The usual oblique incision was employed and the dissection deepened to expose the saphenous opening.

A thin-walled bluish sac was seen arising from the superficial aspect of the internal saphenous vein just before it penetrated the cribriform fascia.

Search of the femoral region failed to reveal any sign of a hernia.

The varix was excised by removing $1\frac{1}{2}$ inches of the saphenous vein between ligatures.

Case III.—Mary C., a Russian married woman of twenty-seven years, was admitted to the New York Hospital on October 18, 1920 with the diagnosis of left femoral hernia.

Chief Complaint.—Swelling in the left groin and pain which radiated over the pubis.

Present Illness.—Five months before, she had noted a swelling in the left groin which increased slowly in size.

There is pain in this area, radiating to the pubis and often running downward toward the knee. The lump disappears on lying down.

Past History.—No significant facts were elicited except that she had had three normal confinements. No illnesses and no operations.

Physical examination on admission revealed an easily reducible swelling in the left groin, disappearing on lying down.

In the erect posture light pressure served to obliterate it, but it promptly returned to its former size without the aid of coughing or other increase of intra-abdominal pressure.

There is definite impulse on coughing, but no contents can be felt, nor is any thrill noted.

The swelling is just below Poupart's ligament and lateral to the pubic spine.

The superficial veins of both legs are slightly prominent, but this had not been noticed by the patient.

Operation.—Incision and dissection below Poupart's ligament exposed a mass of distended, tortuous veins, resembling somewhat the appearance of a varicocele.

These veins lay superficial to the deep fascia and were shown to be derived from the superficial external pudic vein before its junction with the internal saphenous vein.

The mass of veins were excised after multiple ligations. The internal saphenous vein appeared normal and was not ligated.

There was no weakness in the region of the femoral ring and canal.

Discussion.—These 3 cases serve to illustrate the possibility of confusing a varix in Scarpa's triangle with femoral hernia, and it must be admitted that such an error may readily be made.

Indeed, each of the cases above cited was referred to the hospital under an erroneous diagnosis of "hernia."

In the earliest case of the three (Case II) the correct diagnosis was made only at operation, but, profiting by this experience, we were enabled to arrive at the accurate diagnosis of varix in Cases I and III after careful weighing of the clinical findings.

Diagnosis.—In no one of these cases did the history furnish any definite clue to the diagnosis.

In each case there were noted slight varicosities of the veins of the legs below the knees, and although such a condition may exist in conjunction with a true femoral hernia, it should be given much consideration in arriving at the diagnosis, for it would naturally be expected as a concomitant in cases of varix in Scarpa's triangle.

Differential Diagnosis from Femoral Hernia.—1. *Site.*—The position of the swelling is almost identical, but in varix it lies usually definitely below and separable from Poupart's ligament, and there is no upward extending neck or stalk.

2. *Reducibility.*—This is very easy and complete in varix, whereas in hernia it is usually only partial and often entirely impossible.

In the erect posture pressure will reduce a varix, but it rapidly resumes its original size, without the aid of coughing or otherwise increasing intra-abdominal pressure.

3. *Consistency.*—In varix the tumor is soft, almost gaseous in consistency, and no contents can be felt, whereas in hernia one may commonly feel the resistance of incarcerated omentum or other viscera.

4. *Thrill.*—In 2 of our cases a thrill was felt in the tumor on coughing, but this is not to be considered an important point, because it is usual to feel a thrill in the femoral vein when examining the femoral region, even in normal individuals.

5. *Color.*—In a thin-skinned individual a bluish hue over the tumor would be in favor of varix. (See Case I.)

6. *Varicose Veins of the Legs.*—The presence of such a condition is not pathognomonic of varix, but should always be given due consideration and weight.

Conclusion.—Varix of the internal saphenous vein or its tributaries in the region of Scarpa's triangle may be readily confused with femoral hernia, but we believe that a painstaking examination, bearing in mind the differential points above mentioned, should in most cases establish the correct diagnosis.

CLINIC OF DR. HAROLD NEUHOF

Bellevue, Mount Sinai, and Montefiore Hospitals

Introduction.—In selecting these cases for presentation my purpose is: 1. To illustrate the difficulties sometimes encountered in the diagnosis of the existence, situation, and nature of a spinal cord tumor. 2. The description of a new method for localizing spinal cord neoplasms. 3. The relief of intractable pain from a cervical tumor by high cervical division of the anterolateral tract. 4. Technical problems and problems in interpretation at operation. I shall make only brief mention of the essential neurologic manifestations presenting in the various cases.

INTRADURAL ENCAPSULATED METASTATIC ADENOCARCINOMA ATTACHED TO CERVICAL CORD

Severe Pain; Localization of Neoplasm by a New Method: Air Roentgenography. Laminectomy and Subcapsular Removal of Tumor Without Relief from Pain. Second Operation: Section of Anterolateral Tract at Third Cervical Segment, with Complete Relief. Incision of the Spinal Cord Through the Fibers Carrying Sensation of Pain and Temperature is Devoid of Pain.

Mrs. S., forty years old, was admitted to Bellevue Hospital six years after a radical amputation of the breast for adenocarcinoma had been performed. About two years before admission she began to have pain in the right arm, later radiating from the right shoulder to the back of the neck and head. In the last six months the pain has become progressively more severe. Some time after the onset of pain weakness in the lower limbs was noted, more marked on the right side. The patient has been bed-ridden for several months, partly from the severity of the pain, partly from weakness in the lower extremities. Shortly before her admission she first noticed vesical urgency.

I shall not detail the neurologic manifestations. Suffice it to say that there was a suggestion of a Brown-Séquard syndrome, the right side preponderatingly motor and the left side sensory. At no time could a sensory level be found referable to a lesion of the lower cervical cord. This held true at repeated examinations. The head was held stiffly. There was slight inequality of the pupils.

The provisional diagnosis was a spinal metastasis pressing upon the right half of the cord somewhere in the cervical region. It was anticipated that the *x*-ray examination would outline the lesion clearly in this region, particularly in such a thin individual, but the *x*-ray was entirely negative. Pictures taken of the head, chest, and extremities to determine the existence of metastases were also negative. The question arose as to whether we were dealing with a spinal metastasis or some other form of tumor that had happened to develop in a patient who had had carcinoma of the breast. This could not be decisively answered, of course, but in favor of the latter was a totally negative *x*-ray of the spine and examination elsewhere for the presence of metastasis. It was therefore concluded that an exploratory laminectomy was justified, and that without waiting for a well-defined sensory level.

The question arose what other methods could be employed to aid in the localization of this neoplasm. Some years ago I had shown that the subdural space in animals could be clearly outlined by collargol introduced through lumbar puncture, and that in these experiments an impingement upon the dural space (by a mass artificially introduced) would block the flow of collargol and that the block would show up in the *x*-ray. It was realized that collargol would be too irritating for this purpose in the human being, and, therefore, I was led to the use of thorium. This also proved too irritating. In some of Dandy's work air was introduced intraspinally and permitted to flow up into the skull without any evidence of irritation of the cord. I therefore concluded that it would be reasonably safe to withdraw spinal fluid and replace it by equal quantities of air, with the expectation that the air would be blocked and not flow freely above the situation of the tumor. This proved to be the case in this patient.

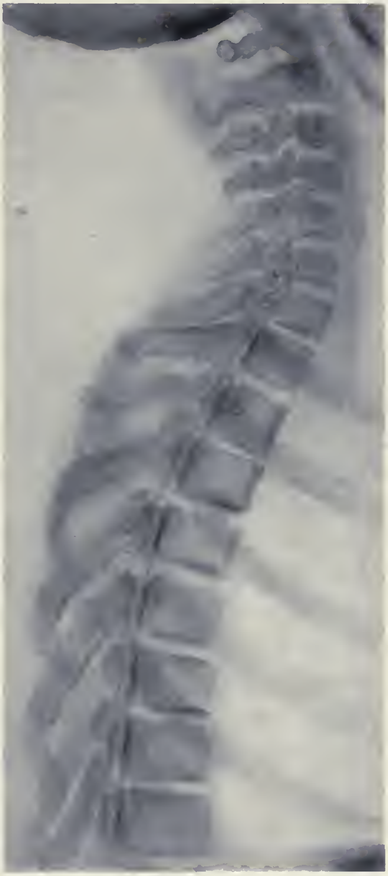

Fig. 736.—Reconstruction from *x*-ray pictures to show air column surrounding cord and stopping in lower cervical region to become trabeculated there in the neighborhood of the tumor.

Three weeks after admission to the hospital the patient was taken to the *x*-Ray Department, a lumbar puncture needle inserted to which a two-way stop-cock and syringe were attached. In 10 c.c. amounts about 50 c.c. of spinal fluid were withdrawn, and the same amount of air introduced into the canal without pressure. The pelvis was then elevated to avoid, as far as possible, the flow of air into the cranium. The *x*-ray pictures were taken in this position and the patient kept in bed in a similar position for two days. The only complication from this procedure was nausea and vomiting and some headache, which cleared up in twenty-four hours.

The *x*-ray plates showed what might be described as a double vertical column of air outlining the spinal cord, uniform in the lumbar and dorsal region, but trabeculated and apparently stopping opposite the sixth cervical vertebra. With this finding, operation in the lower cervical region was decided upon.

Operation.—The spines and laminæ of the fourth, fifth, and sixth cervical vertebræ and, subsequently, those of the third were removed in typical fashion. Tension sutures were passed through the dura and an incision was made between them. There escaped a large quantity of cerebrospinal fluid, and the tumor was immediately exposed, lying to the right of the cord and pressing it far over to the left side. The neoplasm was about 3 cm. long and 2 to 3 cm. in the other axes. It lay opposite the laminæ of the fourth and fifth cervical vertebræ, the poles somewhat overlapping these levels. Overlying the tumor were some thin trabeculations of the pia-arachnoid only loosely attached. Several fine branches of the posterior spinal vessels entered the neoplasm. It was grayish-pink in color and fleshy in consistency, well circumscribed, and encapsulated. The growth or its capsule was intimately attached to the adjacent surface of the cord, in a hollow of which it lay. However, no actual involvement of the cord by the growth could be demonstrated. The inner surface of the dura was free from any involvement, smooth after the removal of the tumor, and presented no evidence that the growth was one which extended from the surrounding bone into the dura. The separation of the tumor from the spinal cord was slowly carried out with delicate elevators. At first an attempt was made to separate the neoplasm from the spinal cord, but the relations were so intimate that this was discontinued. Then the lower pole was slowly dislodged and peeling carried out away from the cord. The growth was split in two in order to remove it with minimal injury, the posterior half being shelled away first, and then the anterior, more deeply seated portion. No visible injury was done to the cord. Except for the possibility that the bed of the tumor in the spinal cord presented slight infiltration, the tumor seemed to have been radically removed. At the end of operation the inner surface of the dura was perfectly smooth and appeared free from any evidence of tumor. Toward the close of operation the cord was beginning to shift back toward its mesial position. The wound was closed in layers in the usual manner, and a posterior molded splint was made to fix the head and neck on the shoulders.

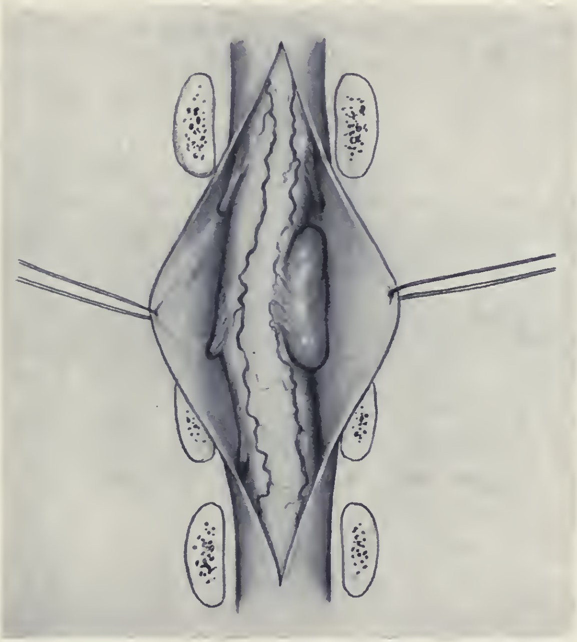

Fig. 737.—Appearance of the well-circumscribed tumor upon opening the dura. Note its intimate attachment to the cord.

Microscopic examination showed adenocarcinoma identical in appearance with the slides of the original breast tumor.

Postoperative Course.—There was absolutely no relief from the pain in the right arm which was the patient's chief complaint before operation. This persisted day after day, requiring frequent administration of morphin. About four weeks after operation it was clear that something further would be necessary to relieve the patient, the presumption being that the pain persisted because of the invasion of the cord by the remnants of the tumor. The patient was gradually losing ground and became querulous, and it was almost impossible to make a satisfactory examination. There was, however, no evidence that the removal of the tumor had been followed by any change in the neurologic manifestations. I therefore decided that the only hope for prolonged relief of pain in the right arm would be a division of the left anterolateral tract above the site of the tumor, that is, at the third cervical segment. The question arose, Could the anterolateral tracts be divided at this level without fatality? I believe it has been stated that these tracts could not be divided above the thoracic region, but the discussion, as I remember it, did not convince me.

Operation Four Weeks After the Primary One—Division of the Anterolateral Tract.—Local anesthesia, 1 per cent. novocain to skin and muscular planes, but none to dura or spinal cord.

The line of cleavage of the former operation was not discovered until the seventh cervical spine was removed. The wound was then laid open bluntly. The silk sutures of the dura were visible as such, the dural incision being firmly healed. They were removed and the dura laid open higher than in the previous operation. The under surface of the dura was apparently adherent to the bed of the tumor on the right side, but this was not definitely determined because the separation on the right side was not carried out. The cord above the level at which the tumor had been situated was freely exposed, particularly on the left side; it appeared perfectly normal. The posterior left fourth cervical root was gently elevated to expose the denticulate ligament beneath it. The latter was divided, caught with forceps, and used as a tractor to rotate the cord. This proved to be unsatisfactory, perhaps because the cord was fixed below at the site of tumor removal. In order to expose this region adequately it was necessary to split the dura laterally on the left side. The cord was then lifted gently with a blunt strabismus hook to expose the third anterior root as a guide to the situation of the anterolateral tracts. With a von Graefe knife a rectangular incision was made across the left aspect of the cord in the situation of the anterolateral tract. The maximum depth of this incision was 3 mm. and its length on the surface of the cord was about 5 mm. Slight oozing followed the incision of the cord. The manipulation of the cord and the incision through the left anterolateral tract were absolutely free from pain, although, as has been said, no local anesthesia was applied. The dura was left open for decompressive purposes and the wound closed in the usual fashion.

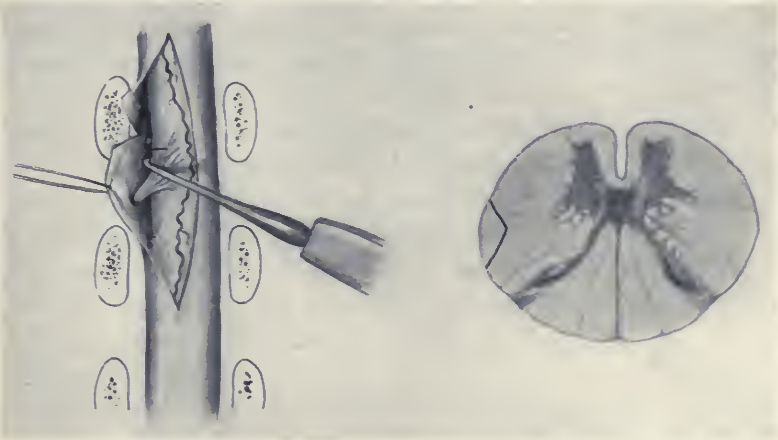

Fig. 738.—Incision of the left anterolateral tract at the third cervical segment. The cord has been lifted and rotated, the exit of the left anterior root being indicated. The part of the cord that was incised is shown in the accompanying illustration.

Strangely enough, the relief of pain in the right arm was not evident the first four or five days after operation, but thereafter it was complete, and the patient never complained of any other sensation than a "rushing of blood" in the right hand.

Incontinence of urine was present for a number of days after operation, and about the same time there were some twitchings in the legs. These manifestations, however, cleared up completely before the patient left the hospital. Upon neurologic examination about one week after operation the loss of temperature and pain on the right side below the level of the third cervical segment did not appear to be complete; indeed, subsequently, islands of retained sensation of temperature and pain were to be found, particularly over the right half of the chest.

The final examination before leaving the hospital showed that this loss was practically complete, and examination subsequently at another institution presented the same evidence of complete or almost complete division of the anterolateral tract. The patient still remains free from pain one year after operation.

ENDOTHELIOMA OF CONUS AND CAUDA EQUINA. DIFFICULTIES IN DIAGNOSIS. LAMINECTOMY AND REMOVAL OF TUMOR. RAPID IMPROVEMENT WITH RETURN OF REFLEXES

In this patient, Mrs. F., fifty-eight years old, the first symptom, beginning three and a half years before admission to the hospital, was burning pain about the left hip. This remained the sole manifestation for two years, when it began to abate. Pain in both feet gradually extending up to the knees then began, and this became steadily worse and more constant. Weakness of the lower limbs appeared soon after, and has been more slowly progressive than the pain. The patient has been bedridden for a year more from pain than disability. For several months there has been vesical and rectal urgency, and incontinence on a number of occasions. Glycosuria has been noted and the case was apparently treated as one of diabetic neuritis.

During three weeks' observation in the neurologic service of Dr. B. Sachs the patient suffered almost constant pain in the lower limbs unless relief was given by morphin. Incontinence of urine and feces occurred occasionally. There was marked loss in power in the legs, more pronounced on the left side, together with some spasticity. Bilateral complete drop-foot. The knee-jerks were absent, the Achilles reflexes present, but reduced. A tendency to ankle-clonus, more marked on the left side, was noted. There was a bilateral Babinski phenomenon. The only discoverable disturbance in sensation was an ill-defined area of very slight reduction in pain and tactile sense over the buttocks. Two disturbing factors in the diagnosis came up. One was a greatly enlarged uterus and the question was if we were dealing with a spinal metastasis from a uterine growth. The other was the *x*-ray examination. This showed a marked spondylitis of the lower dorsal and lumbar vertebræ with well-developed osteophytes, and the dural sac might as a result be sufficiently compressed to lead to the neurologic manifestations I have noted. I shall take occasion in another case to indicate the misleading interpretation that can be made of the *x*-ray examination in spinal cord tumor suspects, but cannot refrain from emphasizing this point here. The *x*-ray examination is of great value in determining the presence or absence of a neoplasm of the vertebral column. It is of no value in demonstrating the presence or absence of a spinal cord tumor except in those rare instances of calcification in the tumor. The fact that the *x*-ray plates show the results of arthritis of the vertebral column, even when localized over the area in which a tumor is suspected to exist, as in this case, should in no way quiet a previous suspicion that a spinal cord tumor may be present.

I shall not enter into the interesting details of the question of localization of the tumor suspected to have been present in this case. They illustrate anew that the stereotyped pictures of affections of the lumbosacral cord, the conus, and the cauda equina, often contrasted in table form in text-books on the subject, can be greatly altered by the tumor. There was sufficient evidence to justify a provisional diagnosis of a tumor in the region of the junction of cord and cauda equina and, therefore, to justify operation.

Operation, with Comments.—The spines and laminæ of the eleventh and twelfth dorsal and first lumbar vertebræ were removed to expose the termination of the cord and the beginning of the cauda equina. Upon opening the dura between traction sutures there was an escape of normal quantities of cerebrospinal fluid. After the excess fluid was mopped up the conus and beginning of cauda equina were found adequately exposed and were inspected. A tumor was not seen. The conus and upper cauda were found pushed back and rotated to the right, so that the left lateral surface of the conus and the left half of the cauda were chiefly visible in the field. The first impression was, therefore, of a tumor of the body of the twelfth dorsal vertebra as the cause of the dislocation of the cord structures. However, by gentle traction on the pia-arachnoid attached to the conus and a little dissection anterior to it, the lower rounded pole of a tumor was seen extending just below the end of the conus. The problem of attempt at removal now came up. Additional dissection showed that a number of roots of the left half of the cauda equina and some from the right side were intimately attached to the capsule of the tumor, but that the ventral surface of the conus was not adherent. It was manifestly out of the question to sacrifice the attached roots unless grave additional loss of function of sphincters and the lower limbs was to be inflicted. Further

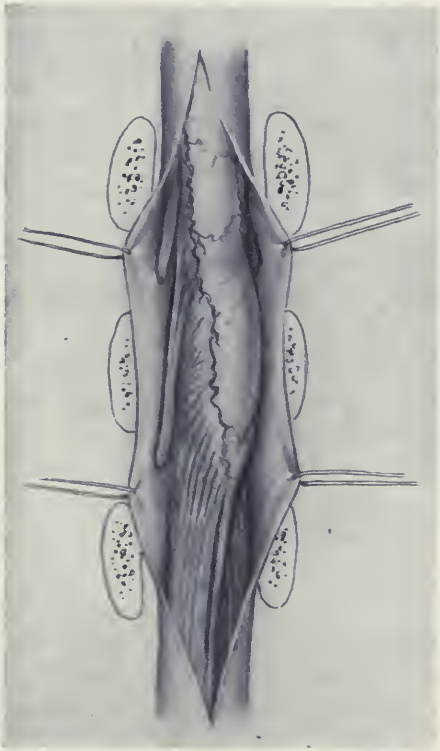

Fig. 739.—Posterior bowing and rotation of conus and cauda equina seen when the dura was opened. The tumor became visible only after these structures were displaced.

isolation of the neoplasm away from the cord structures was decided upon. The tumor was then found to be a hemispheric one about 2.5 cm. in each diameter, occupying the entire space in front of the cord structures and broadly attached to the inner surface of the dura anteriorly. Accordingly, I decided to attempt to shell it out here, although I could not be certain that the tumor did not arise from the bone. By an incision of what was found to be an outer capsule and patient dissection in this plane of cleavage the tumor was lifted out and was free to the line of attachment of capsule to roots of the cauda equina. Here the capsule was detached by sharp dissection, leaving a thin layer attached to the roots of the cauda equina, and the tumor was free. After its removal the field was inspected. Apparently complete removal of the neoplasm had been accomplished with the possible exception of the narrow strip of capsule left attached to the roots of the cauda. There was no bleeding within the dural sac and the wound was closed in layers in the usual manner. A voluminous dressing incorporating layers of gutta-percha was applied in order to protect the incision from urine and feces. As I have stated, the tumor was spheric, about an inch in each diameter, of grayish color, and of rather firm consistency. Microscopic examination: Endothelioma.

The patient was placed on a water-bed, her skin kept dry and clean, and her position changed from time to time to avoid the appearance of pressure lesions. I believe the significance of so-called bed-sores that appear in cases of spinal cord tumor or injury is clear. I cannot subscribe to the view that they are "trophic" lesions referable to the cord injury, certainly not in the great majority of instances. Conceding a greater tendency to their development in spinal cord affections, I believe their appearance can be directly ascribed to poor nursing care, and, conversely, their non-appearance to good nursing. A tribute should be paid to the nurses who served in the front area during the World War as regards the care they gave to the unfortunate sufferers from spinal cord wounds. Despite the fact that their hours were fully occupied they managed to take sufficient time to look out for these patients. I cannot recall a single instance of bed-sore among all the spinal cord injuries we cared for at United States Mobile Hospital No. 2.

The day after operation all the reflexes present previous to operation were obtained. I make a point of retention of reflexes as significant of minimal cord trauma in another case and shall not stress it here. The root pains disappeared promptly. The right knee-jerk appeared for the first time five days after operation, the left knee-jerk returning several months later. Beginning recovery from drop-foot was noted nine days after operation, and thereafter the improvement in power in the lower extremities was rapid. Complete continence of the vesical and rectal sphincters existed two weeks after operation.

Improvement continued after the patient left the hospital. It is now one year since operation. There is occasional pain in the left thigh, some vesical frequency during the day, and a little weakness in the left leg as compared with the right. Otherwise the patient is well as yet. Power in both limbs is excellent, although the right leg exceeds the left. All reflexes are present, the Babinski phenomenon not obtained. There are no discoverable sensory disturbances.

GIANT ENDOTHELIOMA OF MEDULLA. SUBOCCIPITAL CRANIOTOMY AND REMOVAL OF ARCHES OF ATLAS AND AXIS UNDER LOCAL ANESTHESIA

The symptoms in this patient (Mrs. S., thirty-eight years old) began during a pregnancy eighteen months ago. Severe and persistent occipital pain was the first manifestation, to be followed by weakness of the right arm and, later, of the right leg. Despite the progressive course of these symptoms parturition was normal. One year ago weakness of the left arm was first noticed, to be followed shortly by weakness of the left leg. Finally, all four extremities became considerably wasted and almost completely paralyzed. Difficulty in urination and constipation began about four months ago, have been progressive, but incontinence has not developed. Shortly before entering this hospital the patient was under observation for a month at another institution, where a diagnosis was made of gliosis involving bulb and cord. Difficulty in breathing first appeared during that period.

Outstanding features of the physical examination were: Marked atrophies and paresis of all four extremities, more profound on the right side, with superficial reflexes absent and deep reflexes greatly reduced. All sensations diminished or lost over the entire body except the face and anterior half of the scalp. Limited motions of the head, wasting of some of the musculature of the neck. Lateral nystagmus. Paralysis and fibrillary twitchings of right half of tongue. Respiration purely diaphragmatic, with absolute immobility of thorax, labored, and rather hurried.

During the period of nine days' observation before operation occipital pain became more severe and at times agonizing; the patient complained of a sensation of heavy weights pressing on her body, but the most alarming symptom was the rapidly increasing difficulty in breathing.

Diagnosis.—A detailed discussion of the neurologic manifestations would be out of place. I may say, however, that the march of events was classic for a spinal cord tumor in the cervical region—involvement of arm and leg on one side, then the arm and leg on the other, and the later development of bladder and rectal disturbances. There would have been little difficulty in diagnosing a tumor lower down in the cervical cord and the patient would undoubtedly have been operated upon at a much earlier period under those circumstances. Tumors involving the medulla are so unusual, however, that a hesitancy in making such a diagnosis is not surprising, and commoner bulbar lesions are considered. But in this case the root pains over the occiput, loss of sensation over almost the entire body, and the evidences of medullary involvement, in addition to the quadriplegia, clearly indicated a tumor pressing on the medulla from the right side.

One finding in the physical examination I have not mentioned was a rounded prominence in the region of the body of the second or third cervical vertebra as felt through the pharynx. This in conjunction with the *x*-ray examination, showing an increased density and tendency to coalescence of the bodies of the upper three cervical vertebræ, led to a consideration of such conditions as osteoma or a high cervical Pott's disease in the diagnosis. These were ruled out because of insufficient evidence. I wish to say that in my experience the result of *x*-ray examination of the spine in cases of suspected spinal cord tumors may be misleading. Roentgenologic examination is, of course, of prime importance in the diagnosis of tumors involving the spinal column, and is essential in the effort to exclude these lesions if a spinal cord tumor is suspected. But when the *x*-ray picture shows lesions such as arthritis of one or more articulations, exostoses, etc., it is unwise to leap to the conclusion that these lesions are the cause of the spinal cord condition. I have met instances in which such false interpretation has led to unfortunate delay in operation.

Indication for and Plan of Operation.—The quadriplegia and muscular wasting in this patient were advanced, and much improvement by operation could not be anticipated in this direction. The chief indication for operation and, indeed, an urgent operation lay in the impending respiratory failure from medullary compression. The plan, therefore, was to expose the region of the medulla widely in the hope of encountering a tumor that could be lifted away from it and thus relieve compression—direct decompression. In order to do so safely it would be necessary to remove the lower part of the occipital bone including the posterior half of the foramen magnum and the arches of atlas and axis, and to incise the dura over the cerebellar lobes before opening it over the medulla. General anesthesia was, of course, contraindicated by the respiratory condition, and I believed that relatively little local anesthesia would be necessary in view of absent or diminished sensation in the proposed operative field. This proved to be the case.

Operation.—With the patient in the prone position and shoulders up to the end of the table her head was supported in the lap of an assistant. I find this more satisfactory than the use of a metal head-rest in laminectomy in the cervical region or in suboccipital craniotomy. After infiltration with 1 per cent. novocain in the skin and $\frac{1}{2}$ per cent. solution in the depths a cross-bow incision was made as for a suboccipital craniotomy, the vertical half being extended downward somewhat further than in the Cushing incision. The musculature having been divided transversely close to the occipital bone and separated in the median line down to the third cervical spine, the periosteum was stripped away. Trephine openings were then made in the occipital bone on each side of the median line, the openings joined up, and the lower part of the occipital bone removed with rongeurs. This part of the operation, practically the same as a suboccipital craniotomy, is often trying because of profuse bleeding, and I had occasion in this case as I have had in other suboccipital craniotomies to note the relatively insignificant bleeding that goes with the use of local anesthesia for the operation. To obtain the widest latitude for medullary decompression the posterior three-fourths of the rim of the foramen magnum were removed. The marginal sinus was then tied off on both sides and the arches of atlas and axis were widely excised with rongeurs.

The dura over cerebellar lobes and medulla was tense, slightly pulsating. It was divided transversely across the median line, the straight sinus caught between fine clamps and tied off. There was an escape of considerable cerebrospinal fluid under high pressure. The patient's condition remained unchanged. The dural incision was now extended downward vertically over the medulla and upper cervical cord. A firm, rounded, reddish-gray tumor came into view at once, occupying almost the entire spinal canal. Only a thin strip of medulla and upper cord could be seen crowded far over to the left, The upper pole of the tumor lay beneath and between the cere-

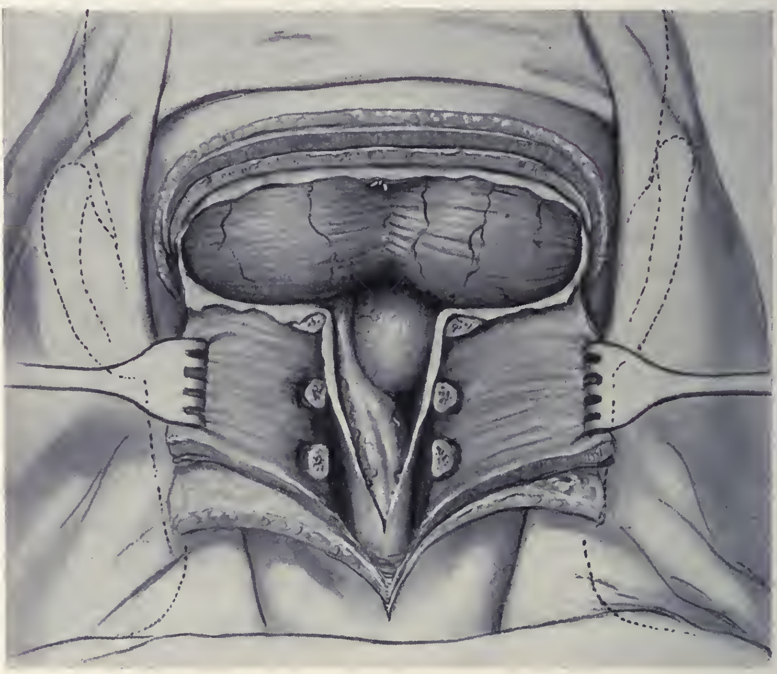

Fig. 740.—Appearance upon incision of dura over cerebellum, medulla, and upper cervical cord. The dislocation and compression of the medulla by the tumor are well shown.

bellar lobes, separating them for a distance of 2 to 3 cm. On first impression it appeared a simple matter to lift this tumor out of its bed and thus relieve pressure on the medulla. Blunt dissection with fine elevators was begun away from the medulla and upper cord. The tumor was readily separated from the right lateral surface of the medulla; deeper down, however, it was firmly held in place. I then found that the presenting growth was only one part of the tumor, the remaining and greater portion extending around the anterior surface of the medulla and upward under the cerebellar lobes. To dislodge this major part of the growth would inevitably have meant additional trauma to the medulla already greatly compromised, and I had to content myself with excision of the presenting portion that crowded the medulla to the left. After its removal the medulla and upper cord came well into view, shifting gradually toward the median position. It was astonishing to think that life had been compatible with the degree of compression of the medulla that was now noted—it was seen to have been greatly distorted and compressed to less than one-half the normal diameter. Bleeding from the bare cut surface of the tumor was controlled by pressure. A radium needle was hooked into the growth to be withdrawn by the attached thread later. The dural incision was left wide open, musculature, aponeurosis, and skin were closed in layers.

Postoperative Course.—There was no evidence of postoperative shock, the pulse returning to its previous rate and quality shortly after operation and the respirations remaining unchanged. About thirty-six hours after operation, when the patient's condition appeared satisfactory, respirations ceased without the slightest warning and could not be brought back. The pulse stopped about ten minutes later.

At the postmortem examination the remaining portion of the tumor was found attached to and apparently arose from the inner surface of the dura anterior to the medulla, and could be lifted out by drawing the medulla to one side and elevating the cerebellar lobes. It measured 3 x 4 x 5 cm. Pathologic examination: Endothelioma.

LARGE CERVICAL CORD TUMOR WITH SLIGHT SENSORY MANIFESTATIONS. LAMINECTOMY AND RADICAL EXCISION OF TUMOR. "CURE" NOT COMPLETE TWO YEARS AFTER OPERATION

Mr. B., forty-seven years old when admitted to the hospital. Eight months before he began to have stinging pains in the third, fourth, and fifth fingers of the left hand, followed by wasting of the musculature of the hand, forearm, and shoulder girdle. Two months later the left leg began to be weak and stiff, so that there was difficulty in walking. Slight stiffness in the right arm and some stiffness of the right leg developed shortly before admission to the hospital. Difficulty in urination became manifest in that period.

The patient was in the hospital for three months before operation, during which time there was little if any evidence that the manifestations of the disease were progressive. Pain in the fingers, complained of at the outset, had largely subsided. He was up and about, without increasing difficulty in locomotion. These facts are all the more remarkable in the light of the lesion found at operation.

Examination.—The right pupil was slightly larger than the left. Nystagmoid movements in extreme positions of the eyeballs. Considerable wasting and reduction in muscular power of the left arm, to a much lesser degree of the right. Spasticity and weakness of both lower extremities, with increased reflexes, ankle- and patellar clonus, all more marked on the left side. On the other hand, sensory disturbances were insignificant. Tactile sensation was intact. There was diminished sensation to pain over the ulnar side of the left hand, and to a lesser degree over the left side of the trunk and the left lower extremity. The same could be said of temperature sense, but these findings were by no means definite. A sensory level was at no time clearly established; at only one of the many examinations made by the neurologists of the staff did there appear to be a zone of hyperalgesia referable to the first dorsal segment.

The diagnosis thus rested between a multiple or amyotrophic lateral sclerosis, on the one hand, and an intramedullary spinal cord tumor on the other. Operative intervention was only considered because the latter could not be excluded, and had to be regarded purely in the light of an exploration. With a patient not suffering from the evidences of an advanced spinal cord lesion I regard an exploratory laminectomy as safe as an exploratory laparotomy in a parallel intra-abdominal condition. Exploratory laminectomy can be abused exactly as exploratory laparotomy can be and has been abused. But until finer diagnostic methods can be evolved, the best outlook for improvement in the results of spinal cord surgery rests upon our readiness to advise and accept exploratory laminectomy in early and doubtful cases. The next case I present shows of what little avail it is to remove a spinal cord tumor when cord involvement is advanced and the patient exhausted and debilitated by his disease. In this patient with far less advanced cord compression some sequelæ of cord involvement are left after two years, as we shall see.

Operation, with Comments.—The pupillary differences indicating a lesion low down in the cervical cord, a low cervical laminectomy was decided upon. The patient was placed in the prone position, shoulders at the edge of the table, his head flexed and so supported in the anesthetist's lap. A typical laminectomy incision was made with the removal of the spines and laminæ of the fifth, sixth, and seventh cervical vertebræ. The dura was found tense and immobile. Upon opening it between traction sutures there was a gush of cerebrospinal fluid, and tumor surface or spinal cord containing a tumor at once presented in the dural gap. The spinal cord could not be identified as such and posterior roots were not seen. Even though it was impossible at this stage to determine if the condition was a remediable one, I considered it essential to have a full view if possible of the whole lesion. The point is, that attempts to dislodge a spinal cord tumor without clear visualization of its relations to the cord has every chance of inflicting additional and, perhaps, irreparable damage to the cord. Indeed, the era for specialization in spinal cord surgery shall have passed, I believe, as soon as there is general recognition of the fact that the spinal cord registers, and perhaps permanently, any undue or rough handling. An appreciation of this fact combined with a good working knowledge of neurology should make it possible for any surgeon to perform these operations properly. Adequate exposure is a prime requisite. In this case the spine and arch of the fourth cervical vertebra were removed and the dura opened that much more without finding the limit of the lesion. Accordingly, the spinous process and laminæ of the third cervical were removed and the dural incision further enlarged. The cord was then seen for the first time lying beneath and to the right of the tumor. It was now clear that we were dealing with an extramedullary tumor and it was safe to attempt to dislodge, under inspection, its upper pole. The tumor was grasped and gently drawn upon away from the cord. The upper pole immediately slipped out from under the arch of the axis and the tumor was found to be free from the cord. The lower pole was then withdrawn from its pocket just below the lower limit of the dural incision—the level of the first dorsal spine. The tumor was now free except for its broad pedicle, and, presenting a benign, cystic appearance, the temptation was strong to strip it out subcapsularly. Local recurrence after spinal cord removal is not uncommon and is apparently directly referable to the subcapsular removal of these growths. Unfortunately, such a procedure seems imperative at the present time in those cases in which the capsule is intimately attached to the spinal cord. In this case a little dissection showed that a part of the pedicle was vascular, arising from a convoluted mass of spinal veins lying on the posterior surface of the cord, the remainder of its attachments being two posterior roots entering the capsule of the tumor. The roots were first sacrificed and then the vascular pedicle was tied off with fine silk close to the convoluted mass of vessels I have mentioned. After removal of the tumor oozing from the tortuous network of veins was persistent and was not controlled by tampon. Accordingly, a bit of muscle from the margin of the incision was held in place over the oozing area by the gloved finger—the so-called postage-stamp graft—and this promptly checked the bleeding. The cord was inspected before closure of the wound. It has been pushed forward and to the right by the tumor, was flattened, and presented a long, rather deep depression on the left side where the tumor had rested. The dura was sutured with fine silk and the remainder of the wound closed in layers by catgut in the usual manner. A posterior molded plaster-of-Paris splint for the support of the head and neck was applied.

The grayish-white tumor, of fleshy consistency, was about 9 cm. long, 2 to 2.5 cm. in the other diameters. A number of small cysts were found scattered through the neoplasm.

Microscopic Examination.—Endothelioma with cystic and hemorrhagic degeneration.

The postoperative convalescence was uneventful. Reflexes in the lower extremities were found unchanged in the immediate postoperative course, and catheterization was not required. The reason I indicate this is to emphasize again a point I have made before. It has been said that the knee- and ankle-jerks disappear after spinal operations, to appear in twenty-four hours or later, and these changes have been held to be due to the laminectomy and simple incision of the dura. I have been unable to verify this, and the patient I present is one of a number of examples, I believe, that the postoperative disappearance of reflexes present before operation must be attributed to trauma inflicted on the cord, unavoidable no doubt in some of the more difficult cases, but trauma just the same. Similar interpretation must be made, I think, of catheterization required after operation when it was not necessary before.

Rapid improvement took place in the first weeks after operation, so that one might have been led to anticipate a perfect result. My experience with follow up has shown me how illusory such expectation may be. It is possible to predict improvement, even great improvement, relief of pain, and so on, in many cases, and to find that these come to pass. But I doubt if a perfect result can be looked for when any degree of cord compression has existed for some months or longer.

As in other cases, so here, after the rapid strides in the first month to six weeks, the subsequent improvement has been much more slow. I shall not detail the stages, but briefly indicate the present condition of the patient. He is free from pain. Very slight traces of atrophies are to be seen, but the left hand grip is considerably weaker than the right. The gait is slightly spastic due to the increased tone in the left lower extremity, in which increased reflexes, ankle and patellar clonus are yet present. He is able to do light work, but cannot return to the laborious occupation he had before the disease began.

SMALL EXTRAMEDULLARY TUMOR AT FIRST DORSAL SEGMENT. VAGUE LOCALIZING SIGNS. ADVANCED PARAPLEGIA. PREVIOUS OPERATION AT ANOTHER LEVEL. LAMINECTOMY AND REMOVAL OF TUMOR. COURSE UNINFLUENCED BY OPERATION

In this case, a man sixty-two years old, the illness had begun five years before. Weakness and stiffness of the right leg were first noticed, followed by similar involvement of the left lower extremity. Marked spasticity gradually developed, extending upward from the legs to involve the entire torso. The patient has been helpless for about two years, and has suffered increasingly severe contractions of the trunk and lower extremities. Difficulty in urination appeared as a late manifestation and total incontinence has been infrequent. Bowels became obstinately constipated, with occasional tendency to incontinence. About two years before admission to the hospital a laminectomy was performed in the middorsal region at another institution. A flattened cord was found, and the condition interpreted as lateral sclerosis.

Physical Examination.—At frequent intervals the patient suffered from agonizing contractions of the musculature of the back and chest on some occasions, the lower extremities on others. He was rendered completely helpless by the extreme spasticity of the legs, held in extension and unmovable. All the neurologic evidences of advanced pyramidal tract involvement were present. I shall not detail all the areas of diminished and lost sensation over the lower trunk and extremities, and merely say that they were not precise enough to indicate a tumor level.

The patient was under the care and observation of Dr. Abrahamson for three months before there was any evidence of disturbed sensation of localizing value. It was his opinion that the condition was one of spinal cord tumor largely occupying the ventral surface of the cord, but with the vague sensory changes the level for a possible operative intervention could not be determined. Finally, toward the end of the three-month period, a narrow, ill-defined belt of hyperalgesia could be outlined referable to the third or fourth dorsal segments. In addition, I found a strip of slightly diminished sensation along the mesial aspect of the right forearm and hand (first dorsal segment). The difficulty in localizing some case of spinal cord tumor can be appreciated by the brief recital I have given of the problem encountered in this patient.

As soon as the sensory changes I have mentioned were found, operation was promptly decided upon as the one hope of offering some relief from dreadful suffering, but with no expectation of "cure." Dr. Abrahamson and I agreed that a tumor should be sought in the region of the second to fourth dorsal segments, and, if not found here, to be searched for at the first dorsal segment (in view of the sensory disturbances in the right hand).

Operation, with Comments.—Typical laminectomy with the removal of spinous processes and laminæ of the second and third dorsal vertebræ. The dura was incised between traction sutures with the escape of small quantities of cerebrospinal fluid. The cord presented a flattened atrophic appearance and coursing along its posterior surface was a mass of convoluted distended veins. The picture was similar to what has been termed "varicose veins of the cord," and has been held accountable for symptoms simulating spinal cord tumor. I have never felt satisfied, however, that tumor symptoms could be induced by other lesions found at operation unless the cord is actually compromised or invaded by such lesions; for after the first stage of root irritation tumor symptoms are characterized by the evidences of cord compression. I do not, of course, refer to such gross lesions as hemangioma or aneurysm of the spinal vessels, in which cord compression may be as great or greater than in many cases of tumor. If the suspicion of a spinal cord tumor has led to a laminectomy I believe the most painstaking search consonant with the patient's condition should be made for it, and one should not be content with finding abnormalities that may be secondary to tumor, or, in any event, relatively trivial. I think it should be frankly stated that spinal cord tumors are not infrequently found in regions distant from those in which they have been suspected to exist even with the most careful methods of present-day examination. And so in this case the tumor was further sought by removal of the spine and laminæ of the first dorsal vertebra. No additional lesion being visible, the spine and laminæ of the seventh cervical were removed. An insignificant part of the tumor was now brought into view. For its adequate exposure a portion of the posterior arch or the sixth cervical vertebra was cut away. The tumor was almost completely hidden from view by an overlying cap of pia-arachnoid. After the latter was detached the exceedingly dense small gray tumor, $1\frac{1}{2}$ x 1 x 1 cm., was partly exposed. It was deeply embedded in the right lateral and anterior surfaces of the cord. The purpose of the operation being relief of pressure on the cord and not "cure," no effort was made to remove the tumor with capsule, but rather to shell it out intracapsularly. This was done by blunt dissection away from the cord, but could only be accomplished after considerable dissection owing to its deep and fixed situation. Active bleeding from veins in the tumor capsule was controlled after detachment of the neoplasm. The deep indentation in the cord showed little tendency to fill in after the tumor had been removed. Layer closure of the wound.

Microscopic examination of the tumor: Psammoma.

Subsequent Course.—No improvement could be noted as a result of the removal of the tumor. After a week or two, in which there may have been some reduction in the frequency and severity of the contractions, they existed as before. Spasticity remained unchanged. About six weeks after operation the patient's general condition began to deteriorate, apparently as the result of a pyelonephritis, and he died three weeks later.

CLINIC OF DR. ABRAHAM O. WILENSKY

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THE NEUROLOGIC MANIFESTATIONS OF FRACTURE OF THE SKULL (CRANIOCEREBRAL INJURIES)

Practically alone among all the varieties of injuries to which the human skeleton is subject, fracture of the skull is distinguished by the relative unimportance of the bony lesion itself and by the preponderating gravity of the associated and complicating lesions in its contiguous interior structures, especially those in the brain. Taken by itself a fracture of the skull is a relatively benign lesion, but in conjunction with any trauma to the underlying brain the inocuousness of the total injury disappears; lesions of the utmost gravity result, even to those productive of an immediate fatality. So that, while it is of great importance to possess a complete understanding of the bony lesions as these occur, it behooves us at the same time to endow ourselves with complete comprehensions of those associated lesions in the brain and cranial nerves, in the cerebral arteries and venous sinuses, and in the meninges which can possibly occur; with knowledge of their pathology and of their clinical indications and symptoms by virtue of which these can be recognized. Then these can be immediately corrected when and where possible in the hope that the neurologic lesion can be caused to disappear entirely or, at least, compensated, so that the ultimate damage may be minimized as completely as lies within human power.

The scope of any head injury is very large—from the most insignificant to the most extensive. There are cases in which the cranial injury is of comparatively small size; and there are others in which the entire skull is cracked like an egg-shell.

With bony injuries of such varied nature and extent the associated intracranial injury may show a similar diversification; the injury may be limited to a single cranial nerve; to a venous sinus; to a localized and comparatively small area of contused brain tissue; or the entire brain may be disorganized more or less completely; the latter are immediately fatal injuries. There is no rule about the relative proportions of the resulting lesions in the cranium or in its contained structures, and minimal lesions in any one may be associated with maximal lesions in the other. Between these two extremes the number of possible combinations number infinity.

The lesions in the brain may consist of numerous small contusions localized in a single area or wide-spread throughout the major portion of the brain; pathologically these consist of small capillary ruptures with surrounding minimal and subminimal hemorrhages; they may not be visible to the naked eye and only demonstrable under the microscope. In more extensive lesions there are one or more lacerations in the brain tissue in addition; the amount of hemorrhage is considerable, though not always sufficient to produce perceptible or recognizable symptoms. In others the surface of the brain cortex loses its normal morphology and is replaced by a mass of grumous, blood-stained, semisolid material resulting from a complete disorganization of the normal structure; under ordinary conditions this does not extend very deeply, but after extraordinary exhibitions of violence the disorganization extends both deeply and over a wide area of brain substance. In extreme cases the entire brain is involved; these are immediately fatal cases.

Perceptible lesions in the brain are not limited to these actual destructions of brain tissue or to the severance of established functionating nerve tracts, but may result from extraneous causes. The most common of these is produced by pressure from without either by a depressed fragment of bone or by the pressure of a large blood-clot. The latter must necessarily result from extensive hemorrhage either from a large vessel or from the parenchyma of the brain. The accumulated blood-clot gathers most commonly over the surface of the brain either between the dura (subdural) and the bone or directly over the cortex (subarachnoid). In other cases the clot is situated in the midst of the brain tissue either at the bottom of a deep laceration or independent of the latter. In these last cases the mechanism resembles somewhat that of an ordinary apoplexy; and, because of this, quite frequently there is difficulty in making the differential diagnosis between fracture and apoplexy, especially when no history of any kind is available, as in the circumstance of an unconscious patient picked up on the street. Bleeding can take place into one of the ventricles, and the latter may become acutely distended with fluid and clotted blood and produce most serious symptoms and effects.

Pressure of this kind causes an anemia of the underlying brain, which can go on to necrotic changes unless the pressure is relieved in time. A less common cause of neurologic disturbance is caused by an interference with the blood-supply of some portion of the brain either by pressure upon or by thrombosis, or by both, of some important blood channel, especially the longitudinal sinus. These, too, when relieved in time, either spontaneously or through operative interference, may be followed by a complete disappearance of any perceptible symptoms.

As a general rule it ought to be expected that the underlying brain injury will lie in anatomic relationship with the fractured area. This is, however, not absolutely true. Increasing experience in the autopsy room has demonstrated abundantly that brain injuries may exist in different areas independently of the situation of the skull fracture; indeed, brain injuries have been found independently of any fracture at all. A frequently found finding—just to indicate a single one—is a fracture in the general region of one parietotemporal region and a contusion or laceration of the brain in the general region of the tip of the opposite temporosphenoidal lobe; in these cases a contrecoup mechanism is assumed.

In about 40 per cent. of the patients with head injuries sustained in civil life no abnormal neurologic findings are present. This does not indicate that no brain injury coexists, but rather that many times the injury is either not extensive enough, or is of such a nature as to produce no perceptible subjective or objective symptoms. Cases with no neurologic symptoms at the time of examination can be divided into two groups: (1) The very mild cases, the cases with scalp contusions and lacerations in whom fracture of the skull is not suspected, but subsequently demonstrated by *x*-ray examination. These make up the largest number. (2) Cases with such quickly disappearing symptoms that by the time the patients reach the hospital (usually within an hour) evidence of any neurologic disturbance is not elicitable.

The symptoms which brain injuries associated with skull fracture do produce are one of two kinds. One group of these is composed of general symptoms, related to the brain as a whole, and not referable to any one differentiable area. This group, in its turn, is divisible into two important subgroups: in one of the latter the signs have precise similarities to those general abdominal symptoms which usher in the manifestations of any intraperitoneal lesion, such as the initial abdominal spasm and generalized cramp-like pain. These general symptoms reflect a general or diffuse interruption of brain function, are associated with the primary general contusion and initial hyperstimulation of brain substance, and have most to do with the primary unspecialized functions of the brain. Ordinarily one speaks of this phenomenon as "concussion." Concussion is a temporary phenomenon, and its principal immediate symptom is loss of consciousness; associated and secondary symptoms are headache, nausea, vomiting, and various degrees of shock. Any head injury may exhibit this phenomenon in a very mild or in a very extreme degree. In the former the symptoms disappear quickly and the patient is none the worse for them; in the latter the period of unconsciousness becomes protracted to a considerable interval and may be followed by annoying sequelæ, notably by headache, continuing for a number of weeks or months. In some cases the concussion is of such an extreme degree as to result almost immediately in death; the sudden interruption of the vital functions is of such a profound nature as to make impossible their restoration.

The second of these subgroups is of more vital importance because of the potential danger of its essential features and because of the therapeutic possibilities. I speak of the cases of head injury in which a general and progressively increasing general intracranial compression occurs. The symptoms are general, in that the entire brain is concerned, but a certain amount of differentiation occurs and is distinguisable in the clinical picture because the brain is involved in its major differentiated functions in an order the reverse of their development—that is, from the highest, localized in the cerebral cortex, to the lowest, localized in the medulla. Compression appears very quickly in most of the cases. An initial stage of concussion is not always distinguishable in the clinical picture. The cause of such compression is almost always hemorrhage, and the commonest source of the bleeding is the middle meningeal vessels. Compression can also occur from edema. The typical signs of a progressive intracranial compression following an injury include: (1) progressively increasing stupor; (2) progressive slowing of the pulse and respiration; (3) a rise of the blood-pressure followed by a fall in the later stages; (4) swelling of the optic nerve heads; (5) contracted pupils which dilate in the later stages; (6) Cheyne-Stokes' breathing; other neurologic symptoms and signs may coexist. The compression that needs attention and requires early treatment is a progressive phenomenon; it includes a progressive compromisation of all the centers proceeding from those high in the cortex to those low in the medulla. It is most important to recognize the condition before the medullary centers are involved; before that a prompt relief is possible; later any relief is questionable and fatalities usually occur. The danger signs include: (1) very slow pulse and respiration; (2) low blood-pressure, and (3) dilated pupils; these are the signs which indicate medullary involvement.

Cases of compression are frequently complicated by well-marked signs of focal lesions, and in any given case it is important to be able to make proper judgment as to the relative importance of each component in the clinical picture. This is not always possible. It is important to remember that under all circumstances a progressively increasing intracranial compression demands immediate treatment; symptoms of other neurologic disturbance may be studied and treatment can be postponed until a proper moment arrives.

It is very important to be able to recognize those of the cases of compression which are due to edema alone, inasmuch as in these cases operation is not suitable or is of no avail, and may, possibly, do harm. The notes of Case I illustrate:

Case I.—A boy nine years old was run over on the street and was immediately thereafter brought to the hospital. On admission the boy was in stupor and was bleeding from the nose and mouth. The neurologic findings included: (1) left facial weakness; twitchings of the upper limbs; (2) convulsions beginning in the left arm and spreading to the left leg and to the opposite side of the body. Signs of intracranial compression intervened and grew more marked during the next twenty-four hours, when it was determined to go in and relieve the compression. The exploration through a bone-flap showed that (1) no hemorrhage was present; (2) great tension and edema of the brain; (3) some bloody serum in the basilar portion of the skull. No improvement followed the intervention and death followed twenty-four hours later.

The clinical picture in this case was definitely one of a progressively increasing intracranial compression and the character of the associated neurologic findings are those that ordinarily indicate the probability of a rather large hemorrhage. Yet exploration revealed only a marked edema of the brain. The differential diagnosis of intracranial compression from hemorrhage and that from edema is extremely difficult and is rendered more so by one's efforts to be as conservative as one can with head injuries. When the intracranial compression is due to edema, spontaneous recovery is possible. Our second case illustrates this point very well:

Case II.—This four-year-old boy was picked up unconscious on the street and brought to the hospital. No history of any kind is available, but a laceration on the forehead indicates that a head injury of some kind has taken place. When first seen the patient was in deep stupor, with loud, noisy, stertorous breathing, and, altogether, looked very badly. The pupils were widely dilated, although they still reacted to light; and in the fundi the disk margins were distinctly blurred, especially on the nasal sides. There were no neurologic phenomena except an active condition of the knee-jerks. The systolic blood-pressure was 95 mm. Hg. and the diastolic was 65 mm. Hg.; the pulse was beating 68 times to the minute. There was no doubt that some compression was present and the signs increased somewhat during the next few hours; nevertheless a conservative policy was adopted because the increase in the signs was very little. During the remainder of the day distinct improvement was noted, and by the end of the third day the neurologic status was normal. No intervention of any kind proved necessary.

Compare this case with the previous one. In this last patient compression was present, but undoubtedly the largest part of it, if not its entirety, was due to edema. As the edema subsided the normal functions gradually returned.

The second large group of cases in which neurologic disturbances are present are those in which the signs indicate that only a localized area of brain or nerve tissue is involved. The commonest evidences of such neurologic disturbance is found in the condition of the reflexes. These can exist either alone, as isolated phenomena, or as part of a clinical picture indicating the presence of an extensive lesion in which the condition of the reflexes are necessarily incidental. The various reflex responses which are obtained may be equal or unequal on both sides; may be weaker than normal on one or on both sides; or may be similarly exaggerated. In many of the cases the immediate interval after the trauma, owing to the excessive overstimulation produced by the violence, is marked by a complete inhibition of many or all of the reflexes; such a complete inhibition is practically always a temporary phenomenon, and one can confidently expect that very quickly the reflexes will return either in whole or in such condition as is permitted by the nature of the true resultant injury. Abnormal reflexes, such as an ankle-clonus, a Babinski, a Chaddock, etc., are also frequently present.

These, too, can exist either alone as isolated phenomena or as part of more complex clinical pictures. In the absence of any definite complex of physical signs indicating the involvement of some definite differentiable region of brain and nerve tissue, the presence of changes in the normal reflexes or the presence of abnormal reflexes are apparently without any definite bearing. Let me illustrate this with Case III.

Case III.—About two weeks ago this boy of nine years was injured in an automobile accident; the injury is in the neighborhood of the right parietal region. There was immediate unconsciousness, but no vomiting or external bleeding. The elicitable points in the neurologic status included: (1) eccentric pupils which dilated and contracted alternately; (2) absent abdominal and normal cremasteric reflexes; (3) absent knee- and ankle-jerks; (4) bilateral Babinski, but no ankle-clonus; (5) negative fundoscopic examinations. The *x*-ray showed a Y-shaped fracture in the right parietal region. Consciousness was rapidly regained; examination several days later showed a normal neurologic status, and the boy is now ready to go home.

In this patient the presence of these disturbances in the reflexes have apparently no bearing. It is important to remember this especially from the therapeutic point of view. Symptoms of this kind do not call for any active intervention, and under conservative forms of treatment the patients all make good recoveries. This statement should not be interpreted to mean that these reflex disturbances are mere vagaries which do not reflect any definite pathologic lesion in the nervous system; rather, that when they do exist, lesions must be present which are, perhaps, trivial, and can be recovered from fully, or which can be made good by compensatory functional efforts.

Symptoms indicative of injury of a differentiable area of brain or nerve tissue—that is, focal symptoms—may be referable to any part of the body; they are present in from 20 to 25 per cent. of the patients. In many the symptoms are apparent immediately; in others the development of the complex is gradual; in one of our cases the symptoms appeared a fortnight after the reception of the injury.

Among the cranial nerves the facial and auditory nerves are the commonest seat of disturbance after craniocerebral injuries; not always does complete recovery follow. In one of our cases total blindness followed; this was probably an optic nerve lesion.

Focal signs referable to the extremities are most common. These may be generally grouped as those in which paralysis occurs and as those in which there are signs of cortical irritation. It is important to remember that frequently the symptoms of this general latter nature which are present immediately after an injury are due to the stimulation of the initial violence, and that these are only temporary phenomena. One should wait a sufficiently long time to make sure that these are established symptoms before they are accepted. Our next case illustrates this point very well.

Case IV.—This young boy was admitted to the hospital a number of days ago in an unconscious state within a very few minutes after having received a head injury in an automobile accident. Almost immediately he began to have clonic convulsions in one upper extremity, which rapidly spread to the lower extremity of the same side. These were repeated a number of times during the next fifteen minutes. Our house surgeon immediately notified me and I saw the patient within a half-hour—about one hour—after the injury. The convulsions were repeated once more as I was examining the child, so I had orders given to prepare the operating room, being under the impression that some intervention would be necessary. Within the next fifteen minutes, however, the child seemed to begin to come out of its unconscious state somewhat and the convulsions ceased and did not reappear. Operation was therefore not done, and we were all much gratified to see the child come out of its stupor during the night and to observe that no further convulsive seizure took place. As you see, the boy is now perfectly well.

Focal symptoms of an irritative nature need not necessarily be limited to any one extremity. All of us are familiar with the well-known forms of Jacksonian epilepsy limited to a single group of muscles; similar symptoms may occur immediately after craniocerebral injury. Cases in which there are various degrees of spasticity in one or more extremities are also common. Case IV illustrates the type of case with convulsions. When these are not temporary phenomena, but are well established, they form imperative indications for operative interference. However, as we get to these more and more severe cases, whether the signs are those of irritation, or whether they be those of inhibition, the nature of the total injury is often such as to cause either an immediate or fairly immediate fatality, or to make futile any operative interference. This statement applies with great force to all of the observations in this clinic. Let me illustrate with the notes of the following case:

Case V.—This patient was a man of adult age who was admitted in a comatose condition with constant twitchings in the left upper and lower extremity. There were no external evidences of any kind pointing to the probable location of the site of injury. The left side was hypertonic and exhibited exaggerated reflexes; the right side was hypotonic with diminished reflexes; a bilateral Babinski could be demonstrated. The very serious nature of the injury was more than amply evidenced by these findings, by the general condition of the patient with the extreme condition of shock, and by the widely dilated pupils. A bilateral craniotomy was, nevertheless, done as a last resort and showed: (1) fracture of the left vault; (2) rupture of the middle meningeal artery; (3) subdural and subarachnoid bleeding with much brain laceration; and (4) bloody cerebrospinal fluid under great tension. The patient died, of course.

A fatality after an injury of this kind is to be expected; one cannot hope to do impossibilities.

Focal symptoms of a paralytic nature are classified as regards the number of extremities involved: monoplegias—when one extremity only is involved; diplegias—when two similar extremities are involved; hemiplegias—when one-half of the body is involved. Paralytic symptoms are in the largest number of the cases due to some form of pressure upon the cortex; naturally the pressure is produced either by a depressed fragment of bone or by blood-clot. In either case symptoms of this kind lend themselves more than any other to relief by operative intervention. And when the nature and result of the total damage done is such as not to form any insuperable obstacle operation should always be undertaken. Luckily, the relief of symptoms of this kind is not always, or even usually, a matter of any immediate urgency, and one can permit sufficient time for the ample recovery of the patient from the initial stage of shock, or for the improvement of any deterioration in his general condition; then at the earliest opportune moment which presents itself the damage is repaired.

The following cases illustrate these various aspects of craniocerebral injury.

Case VI.—This man of thirty-nine years sustained his injury by falling from a truck which he was driving. Although he landed on his head, he was able to walk to the hospital, where, on admission, he complained only of headache and dizziness. Shortly thereafter he fainted and went into stupor, and the latter alternated with a short period of consciousness. The essential symptoms included a left hemiplegia and the signs of a progressing general intracranial compression. Operation was done within two hours of the reception of the injury, and showed an extensive stellate fracture into the base with depression of the fragments and a large extradural hemorrhage. The clot was cleaned out and, after the bleeding had stopped spontaneously, the cavity was drained by a strip of gauze and the outer wound was sutured. The operation had an immediate good effect; the latter has persisted and has become progressive.

This case is illustrative of a number of important points. It demonstrates a very typical picture. A patient having received a head injury has successive periods of consciousness and unconsciousness which quickly deepens to stupor. The signs of a progressively increasing intracranial compression are associated with the established signs of a focal paralytic lesion; these together should in most of the cases indicate to one's mind that the actual lesion is due to hemorrhage. The progressive nature of the intracranial compression created the imperative demand for immediate operation, and the nature of the total injury was not excessive and permitted an operative interference. The rapid relief of symptoms is characteristic.

Case VII.—One hour before admission the patient had fallen down an elevator shaft. The physical examination showed: (1) a semiconscious patient in marked shock; (2) a large hematoma in the right parietotemporal region; (3) bleeding from the right ear; (4) a complete left hemiplegia; (5) immediate loss of all reflexes which shortly began to return; the left reflexes were all exaggerated, there was a left inexhaustible clonus and a right exhaustible clonus; (6) signs of compression, the pulse dropping to 44 beats per minute; (7) distention of the vessels of both fundi with hemorrhages. Operation was done four hours later and showed a depressed fracture running from the mastoid and temporal bones to the occiput; a plum-colored dura and a perforation of the lateral sinus; extensive hemorrhage and laceration of the brain. A contralateral decompression was done in addition. There was considerable immediate improvement, but after twenty-four hours the symptoms were much worse and a fatality ensued.

In a general way the symptomatology of Case VII was similar to that of Case VI. The nature of the pathology was much different because there was present (1) destruction of brain tissue and (2) injury of one of the venous sinuses. Both of these and especially the latter create very serious lesions, and the total injury is often of such a nature as to forbid any successful outcome. Injuries of the venous sinuses are complications of most extraordinary gravity; and in a series of 5 operated cases all but 1 died. The clinical picture includes most often the sign of a progressive intracranial compression. When the sinus is exposed during operation the bleeding is tremendous; it is controlled best by muscle tissue excised from the neighborhood and held over the opening in the sinus for a few minutes, when it rapidly becomes agglutinated.

A group of cases with longitudinal sinus injury have been segregated by Holmes and Sargent which exhibit a characteristic symptom complex called the "longitudinal sinus syndrome." Holmes and Sargent's experience was derived from the war work. Cushing has pointed out that these cases have their counterparts in the traumatic spastic paralyses of childbirth—the so-called Little's disease. The pathology includes compression or laceration of the longitudinal sinus or of some of its anastomotic branches in the neighborhood of the motor cortex, with, frequently, associated injuries in the paracentral lobules or in the convolutions bordering the fissure of Rolando; thrombosis of the sinus is frequently found.

Symptomatically there are two groups of cases, the essential attribute of both being a spastic paraplegia, and the differentiation being made upon the presence or absence of a sensory ataxia. The important feature of the paralysis is its extreme rigidity. In this syndrome pain and temperature perceptions are unaffected and the tactile sensibility is not perceptibly diminished. The power of discrimination of compass points and the deep muscle sense can show marked abnormalities. The sensory disturbances are found most commonly when the injury is some distance behind the Rolandic fissure.

The symptoms need not be permanent, and when there is no brain destruction and the thrombosis is not too extensive compensation can occur during the establishment of a collateral circulation.

Case VIII.—This illustrates a very severe form of this injury. The patient, a child of nine years, was struck by an automobile. The neurologic status included: (1) unconsciousness, with Cheyne-Stokes' breathing; (2) unequal pupils which did not react to light; (3) marked spasticity of all four extremities. The site of the injury was on the vertex of the skull. The general condition of the patient was very bad and death occurred four hours later.

Case IX.—This boy is eleven years old, and one week ago was struck by an automobile on the left side of the head. The immediate findings included: (1) stupor; (2) deviation of the eyes to the left, with pupils that reacted to light; (3) except for some slight increase of the reflexes on the right side no abnormalities in the upper extremities; (4) lively right abdominal, and absent cremasteric reflexes; (5) marked spasticity of the right lower extremity so that the leg is bent with difficulty and the reflexes are not elicited satisfactorily on account of spasm; (6) a less spastic condition of the left lower limb with exaggerated reflexes and an ankle-clonus; (7) bilateral Babinski; (8) practically negative fundoscopy; (9) a large hematoma of the parietal region. From the symptoms it could be predicted that the lines of fracture would overlay the longitudinal sinus, and so the *x*-ray showed. As you see now, the boy is much better.

Cases VIII and IX present extremes of the clinical pictures of cases showing the longitudinal sinus syndrome. Naturally there are all grades in between. Those that have focal symptoms and are in satisfactory condition should be subjected to operation; in any event they are serious cases.

Case IX brings up the subject of the value of fundoscopic examinations in craniocerebral injuries. The fundoscopic examination with regard to the condition of the nerve head is a factor of established value in cases of increased intracranial pressure which are accompaniments of the development of intracranial tumors or abscesses; under these chronic conditions the presence of a choked disk indicates the presence of increased tension, the successive degrees of which can be compared mathematically with the degree of swelling of the disk; long periods of time are necessary for such changes. Increased intracranial tension with craniocerebral injuries is an acute phenomenon and never does the swelling of the disk approach the extent seen with tumor or abscess formations. What one does see in a few cases is a blurring of the margins of the disk or, at most, a very slight elevation, which is always too slight to be measured. The demonstration of these fundoscopic changes is rather exceptional with craniocerebral injuries, but when the changes are present they form most important evidences of the presence of increased tension; however, the other symptoms of a progressively increasing intracranial pressure overshadow so completely the fundoscopic changes that the latter can be accepted only as corroborative evidence. Under ordinary circumstances the other evidence will be sufficient to enable a judgment of the proper therapeutic course to pursue.

Our ideas regarding the proper course of treatment for craniocerebral injuries ought to be determined on the basis of the average results obtained with the conservative and operative forms of treatment. We have found in our experience that conservative forms of treatment average a mortality of approximately 27 per cent.; compare this with a mortality of 48 per cent. for the operated cases and with a total mortality of 31 per cent., after all forms of treatment. Some of this difference is undoubtedly due to the fact that patients who are subjected to operation naturally have more severe lesions. For that reason I have tried to emphasize in these remarks that patients should not be operated upon when in very desperate conditions. Let me summarize our ideas upon this subject as follows:

1. Conservative and expectant methods of treatment under proper conditions yield the best results. One should be unalterably opposed to indiscriminate operating upon craniocerebral injuries occurring in civil life. As the cases present themselves for treatment one can distinguish that they fall readily into one of three groups: (*a*) A large group the members of which always recover under conservative forms of treatment; (*b*) a smaller group in which the individual patients have received such serious injuries that they are almost certain to die no matter what form of treatment is pursued; and (*c*) a very small group in which the individual patients present such borderline symptoms as to make a decision of the proper course of treatment—whether conservative or operative—most difficult; for these patients a policy of watchful expectancy is most advisable, and one should stand prepared to operate at a moment's notice; the final outcome in these cases is always in doubt.

2. Operation is imperative in every case of advancing intracranial pressure and should be done in the early stages and before there is evidence of medullary involvement.

3. Irritative or paralytic focal symptoms pointing to pressure upon or disorganization of definite cortical areas are the next most important indications for operative intervention. Operations in this group very seldom bear the urgency which is a notable factor in the cases in the second group, and can be

done more at one's leisure. Isolated or irregular disturbances of neurologic function can be discarded from the therapeutic point of view, and for these conservative forms of treatment will yield superior results.

In our experience lumbar puncture has not given complete satisfaction as a therapeutic measure. In mild cases of intracranial compression the release of cerebrospinal fluid has been followed by slight or moderate degrees of symptomatic relief, but in other similar cases the ultimate effect has not been different when no such procedure was practised. In severe and progressive forms of intracranial compressions the release of cerebrospinal fluid by lumbar puncture exhibited no decompressive effect, and much more radical and active measures were necessary to obtain the desired immediate effect.

CLINIC OF DR. MORRIS H. KAHN

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CANCER OF THE LOWER END OF THE ESOPHAGUS

History of 3 Cases: Methods of Diagnosis; Clinical Examination; The Function of the Surgeon in This Disease

CASE I

Family History.—J. L., aged sixty-three, gave a negative family history.

Past History.—He always complained of intestinal disturbances, especially obstruction and constipation. His habits were good. He denied any venereal infection. His weight before his illness was 165 pounds.

Present Illness.—His present illness began one year before he came under observation, with vomiting and substernal distress.

The vomiting occurred five to ten minutes after eating and consisted of the food previously ingested. It never was more in quantity than the amount taken. The vomiting relieved the sensation of pain. At first it took place only after eating solid food. There was no blood in the vomitus. Until a short time before the onset he could retain eggs and milk, and therefore made his diet consist chiefly of these ingredients.

There was a sensation of obstruction behind the middle of the sternum, with dull pain in the same region. He had no abdominal pain, no jaundice, and no urinary disturbances. He had an occasional slight cough, with mucous expectoration.

Physical Examination.—The physical examination showed a moderate degree of emaciation, a resistance to pressure in the epigastrium, and some enlargement of the pelvic glands felt through the abdomen.

Clinical Studies.—Stomach-tubes and bougies were passed from the smallest to the largest size. All of them met an absolute obstruction exactly 16 inches from the teeth. On one occasion there were mucus and blood particles on the tube when it was removed.

The vomitus was alkaline in reaction and showed the presence of many Boas-Oppler bacilli. The stool was negative for blood. The blood count showed a secondary anemia with hemoglobin 58 per cent., and red blood-cells 4,448,000 per cubic millimeter. His weight was 113 pounds, *i. e.*, a loss of 52 pounds. The urine showed a faint trace of albumin, but no sugar or acetone, and a very occasional granular cast.

The pulse, temperature, and respiration were normal. The lungs showed dulness and harsh breathing over the right apex.

x-Ray examination of the lungs made when first seen showed a marked infiltration in the roots and throughout the substance of both lungs. The diaphragm was irregular on both sides and raised considerably in the center. The first pair of costal cartilages showed marked ossification. The appearance was one of pulmonary tuberculosis.

x-Ray of the esophagus made a few days later showed a stricture in the esophagus at the level of the middle of the body of the eleventh thoracic vertebra. Above this the esophagus was very much dilated to the diameter of about $2\frac{3}{4}$ inches (see Fig. 742).

The patient's general condition continued poor for a number of months, with progressive emaciation. There was repeated vomiting a few minutes after eating. After a while he was unable to take any solid food. Fluids sometimes also regurgitated. He had no hematemesis.

The abdomen became more retracted and soft. There was a definite mass felt deep in the left xyphocostal angle in the epigastrium. This mass descended with respiration. There was no tenderness over the sternum and no lateral thoracic or other glands palpable.

Six months later the patient continued to suffer as before, with forced olive oil, eggs, and milk as his only foods. He succeeded thus in gaining some weight despite the frequent vomiting, but the weakness increased. For two weeks nothing at all passed through the cardiac end of the esophagus. Whatever food he ate was vomited together with mucus. He grew extremely pale. The pallor, emaciation, and weakness were the outstanding features at first glance. There was an indefinite tender tumefaction over the gall-bladder region.

The heart continued regular without any murmurs. The blood by this time had fallen to 25 per cent. hemoglobin. The red blood-cells showed anisocytosis with megalocytosis. There were no nucleated red blood-cells. The white cells showed 74 per cent. polynuclears and 26 per cent. lymphocytes.

Soon after, all fluid intake was stopped by mouth and a nutritive enema was given every four hours, consisting of 8 ounces of peptonized milk, the white of 1 egg, 2 teaspoonfuls of sugar, and $\frac{1}{3}$ grain of codein.

The following month the patient's general condition was very poor. There was emaciation, weakness, and anemia. The mass remained indistinctly felt subcostally in the median line on the left side of the epigastrium. It was considered inadvisable to perform gastrostomy.

The patient died of exhaustion and emaciation about one week later.

CASE II

Family History.—A. K., aged sixty-three, gave an entirely negative family history.

Past History.—He had typhoid and malaria as a boy. He took tea and tobacco occasionally, but no alcohol. He denied venereal infection. His weight one year before his present illness was 143 pounds.

Present Illness.—For one year the patient complained of pain in the pit of the stomach which was burning in character. This occurred about a half-hour after eating, lasted about one-half hour, and radiated sometimes to both shoulders, but never downward. This pain was not affected by taking food. It occurred at intervals of a few days, but seemed to be increasing in frequency.

For several weeks there was a choking sensation on swallowing solid and even liquid food. He felt as if there were an obstruction at the level of about the eighth dorsal vertebra. Immediately after, he gagged, brought up some mucus, and expelled the food. There was never any blood in the regurgitated material. There was no jaundice. He lost considerably in weight.

Physical examination showed a moderate degree of emaciation. Glands were distinctly felt in the right axilla and in both inguinal and epitrochlear regions. The chest showed marked clavicular retraction.

The lungs, anteriorly, showed relative dulness in the left supraclavicular region; absolute dulness in the right supraclavicular region, and relative dulness in the right axilla. The breathing was harsh in the apices. There were a few subcrepitant râles on inspiration, more on the left side.

Posteriorly the respiration was good. There was harsh breathing in both suprascapular regions and in the right interscapular region and prolonged expiration and crepitant râles on the right side. In the median line there was bronchial breathing down to the seventh dorsal vertebra, while resonance was good down to the sixth dorsal vertebra.

The heart apex-beat was in the infraxyphoid region. The sounds were weak and there was a slight systolic retraction of the apex. The pulses were equal, regular, and of good force and volume.

The abdomen showed no significant physical signs. The liver percussed from the sixth rib to the free border, but was not palpable. A rectal examination showed small external mucocutaneous tabs. There was slight prostatic enlargement.

Clinical Studies.—Bougies of various sizes were passed and met with obstruction 16½ to 17 inches from the teeth. An Ewald test-meal was ingested without any pain or difficulty and retained for one hour.

A medium-sized stomach-tube was introduced twice, and it also met with obstruction 16½ to 17½ inches from the teeth. A colorless, clear, alkaline mucus was expelled.

Another Ewald test-meal was ingested, with the same results. There was no vomiting or regurgitation this time.

A third Ewald test-meal a week later brought up 25 c.c. of fluid after one hour. This showed: Free acidity, 0; total acidity, 12. There were no lactic acid, no blood, and no Boas-Oppler bacilli present. A small tube introduced at that time met with an obstruction at a distance of 16 inches, but then passed on into the stomach. A large tube was obstructed at the same level and it brought up no gross tissue elements.

The Ewald test-meal repeated a week later brought up no food after one hour. At this time a small tube passed the stricture with difficulty.

Another week later a double Ewald meal was retained for one hour. Through a small tube, which evidently passed the obstruction, 50 c.c. of well digested food were obtained. An examination of this showed:

Free HCl	0;
Total acidity	8;
Blood	0;
Lactic acid	0;
Boas-Oppler bacilli	0.

Ferments showed:

Rennet	0;
Pepsin	Slight.

x-Ray examination made about this time showed a very slight obstruction of the esophagus. The bismuth zoölak was momentarily arrested at the cardia; it then passed in a narrow stream quickly into the stomach. The latter had a steer-horn shape (see Fig. 741).

Four months later the patient had lost much weight, was extremely nervous, bringing up mucus from the throat almost constantly. He ate well and did not vomit, but his bowels were very constipated. He complained of headaches, abdominal and general pains.

In the physical examination small soft bilateral axillary glands were felt. There were no Virchow glands. The heart showed a bradycardia of 68. The abdomen showed no mass or tenderness.

Three months later, after a week during which the patient was melancholic, he refused to take food or medication. On three occasions he lapsed into a stuporous condition, from which he was aroused with difficulty. He had laughing and crying spells. There was no vomiting or convulsions or any other symptoms.

The physical examination showed his apathetic state and emphysema and emaciation. The stomach-tube encountered an obstruction $15\frac{1}{2}$ inches from the teeth. The patient was fed with difficulty by gavage and subcutaneous infusions of 5 per cent. glucose solution. His urine showed a heavy trace of albumin and very much acetone, with an occasional granular cast.

Just about nine months after he first came under observation, and one year and nine months after the onset of the illness, the patient died suddenly of cardiac exhaustion.

CASE III

Family and Past History.—A. H., aged sixty-four, gave an entirely negative family and past history. He lost 25 pounds in six months. His bowels were normal.

Present Illness.—For two months the patient had increasing difficulty in swallowing solid food. He did not regurgitate or vomit, but the food merely took a very long time to get past the cardia. For the last five weeks the passage of fluids was also obstructed.

Physical Examination.—The physical examination showed emaciation, accentuation of the second aortic sound, and increasing pulse tension. The stools were repeatedly negative for blood. The urine was light amber, clear, acid, 1026, with no albumin or sugar.

x-Ray examination made about that time showed an almost complete obstruction of the esophagus at the cardia; only a thin stream of the contrast meal passed through, which was insufficient to empty the esophagus, and it remained filled completely (see Fig. 743).

For two days after the *x*-ray was taken the patient continued vomiting the meal given for the test. His weight at that time was 140 pounds. He continued under observation a little over two months, during which time the obstruction in the esophagus became absolute.

He died following extreme emaciation, marked acidosis, and coma.

DISCUSSION

The characteristic picture presented by cases of stenosis of the lower end of the esophagus is well exemplified in the series presented in detail in this clinic.

Stenosis is the most frequent and practically the most important affection of the food pipe. New growth is probably the commonest cause of it, and even with early diagnosis it is very difficult to achieve anything to modify the unfavorable outlook. The region of the lower end of the esophagus is almost inaccessible to surgical intervention and usually, with late diagnosis, the glands at the base of the neck have already become involved. These so-called Virchow metastases would, of course, in any case forbid radical measures.

Although the finding of the stenosis is comparatively a simple procedure amenable to the various mechanical means of diagnosis, diagnosing the character of the narrowing offers almost insurmountable obstacles. We will take up each of the symptoms as they are presented in the various cases and discuss them briefly.

It will be first observed that the 3 patients were all men. The disease is more frequent in males than in females. It rarely occurs before the fifth decade; the age of our patients is a characteristic period.

Difficulty in Swallowing.—The first symptom observed in all 3 cases and usually the earliest symptom is dysphagia or difficulty in swallowing. This is at first present only after solid food is ingested. Fluids and soft food will pass unobstructed; solid food will regurgitate soon after swallowing. Later on, however, as the part of the esophagus above the narrowing becomes dilated, food may remain down for a longer period, or the regurgitation may continue for a longer time. The rejected material consists of the masticated ingesta and is sometimes mixed with a large amount of mucus, rarely with blood. It may also contain cancerous fragments.

Pain on Swallowing.—Even during its early development the patient will complain of a sensation of obstruction behind some part of the sternum. Sometimes this sensation amounts to actual pain or substernal distress. At other times it is merely interpreted as a pressure of food in its passage through the narrow lumen. The pain may be relieved soon after by vomiting. Later it may be dull and continuous. Sometimes it is burning in character and radiates toward the shoulders or up along the sternum. One of our cases describes it at times as a choking sensation on swallowing solid or even fluid food.

Deglutition Sounds.—Associated with this difficulty in swallowing is a sign of some clinical significance. Normally, after swallowing, there is heard a kind of a ripple along the esophagus, and a few seconds later there is a gurgling sound when the food passes into the stomach. These can be heard just to the left of the lower end of the sternum. If stenosis of the esophagus is present, the esophageal deglutition sound becomes softer and the sound of entering the stomach may disappear.

Emaciation.—Loss of weight is one of the important effects of the malignant new growth. Associated with difficulty in swallowing, it usually indicates cancer of the esophagus. The deprivation of food in these instances by the mechanical obstruction need not be sufficient to cause any alarm. Nutrition may be maintained by the ingestion of large amounts of milk for a long period of time. It is only in cases of cancerous obstruction that fluids may still pass into the stomach and yet loss of weight continue unchecked.

In the clinical examination of these patients lies the secret to the diagnosis. However clear the history may be, among the tests that should have consideration in the diagnosis are:

Passing of esophageal bougies.

Examination of regurgitated contents and of test-meals.

Finding of remnants of tumor tissue in the washings of the esophageal dilatation.

x-Ray examination.

The passing of esophageal bougies is a more or less simple method, and is of great value in ascertaining the patency of the lumen of the esophagus and the amount of obstruction at any particular level. The patient is seated as he might be for the passing of a stomach-tube, or is inclined in the semirecumbent posture. The bougies are assorted from the smallest size to that of an ordinary stomach-tube, and are, one after the other, lubricated with albolene and introduced gently into the esophagus. A medium-sized tube may be tested first; if that meets with an obstruction, it is removed and a smaller size introduced. Care must be taken not to exert any undue force, as the cancerous tissue may be necrotic and friable and damage may be done to that, or a false passage made. The depth to which the tube is introduced must be noted, as it indicates the level of the obstruction.

When a small stomach-tube or Rehfuss tube enters the stomach the usual Ewald or the Rehfuss fractional test-meals are given. The stomach contents will be found to contain less acid than normal or no acid, although the motility may be adequate. The amount of the meal that the stomach will contain will be less than normal, a good proportion of it having been retained above the esophageal obstruction or regurgitated.

In the later stages a stomach-tube will not pass beyond the esophageal tumor. In such cases the regurgitated material after any meal will be found to be alkaline, containing a large amount of mucus, undigested food, perhaps tumor tissue, and frequently blood, and will contain no gastric ferments.

A fragment of tumor tissue and some blood may be adherent to the end of the stomach-tube, or be contained in the lumen at the tip. This should be carefully examined for malignancy under the microscope. Tumor tissue and increase in the amount of albumin contents in the washings of the stomach may also exist due to the peristalsis of tumor material throughout the cardia.

x-Ray examination is of great assistance in the diagnosis of cancer of the lower end of the esophagus. The bismuth or barium meals ingested will outline the esophagus. It will show its compression with narrowing of its lumen or its complete obstruction by the tumor. Spasm of the esophagus will give an altogether different picture and only a transient narrowing. The forms of obstruction, partial or complete, are shown in Figs. 741–743 respectively.

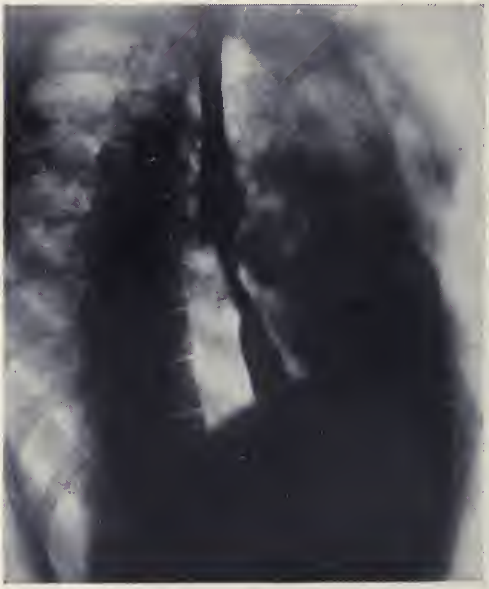

Fig. 741.—Illustrates narrowing of the esophagus by a cancer with beginning dilatation above the lesion.

I am indebted to Dr. Charles Gottlieb, radiographist, for these plates.

The **surgeon's function** in this disease is as a consultant to decide upon the following questions:

1. The possibility of removal of the tumor.
2. Alimentation by means of gastrostomy openings.
3. Treatment by radium.
4. Feeding through sounds.

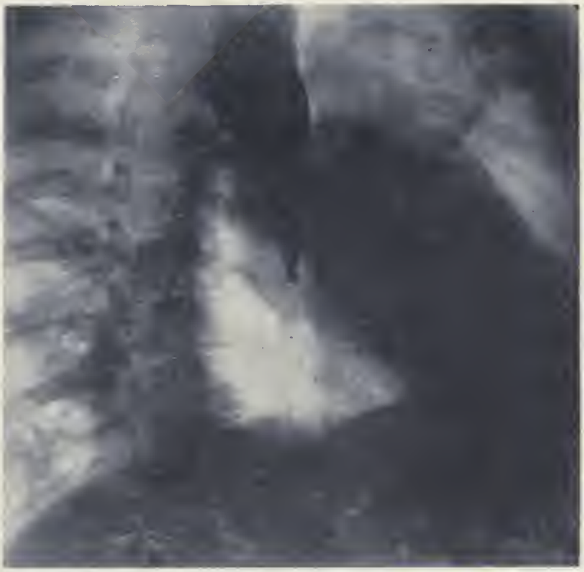

Fig. 742.—Shows irregular complete obstruction of the esophagus with dilatation above.

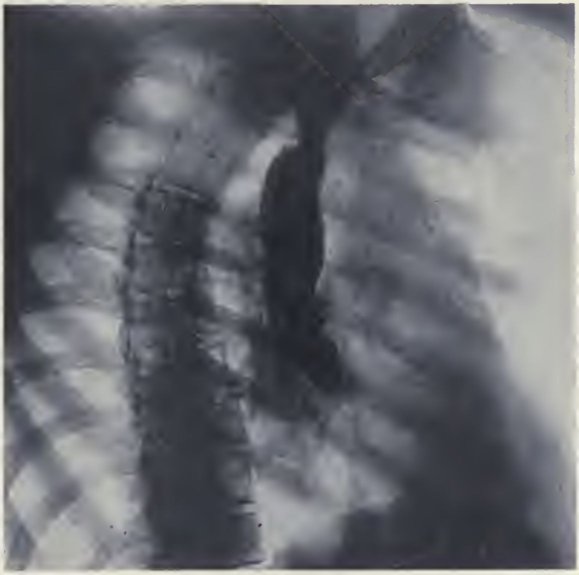

Fig. 743.—Shows complete esophageal obstruction with dilatation of the entire length of the tube to upper end.

The inaccessibility of cancer of the lower end of the esophagus makes removal an extremely hazardous if not impossible procedure, although several attempts have been made in that direction. The mode of approach is through a posterior thoracic mediastinotomy. Postoperative complications, as shock, pneumonia, and cardiac failure due to the sudden intrathoracic manipulation, are especially likely. Reports in the literature are usually like that of Hauch (Beitr. z. klin. Chir., 1914, xcii), who gives an illustrated description of 18 cases of cancer in the middle and lower esophagus in which he succeeded in removing the growth. One patient succumbed to a recurrence a year after successful resection of the cancer in the lower esophagus and cardia. None of the other patients survived the operation for the following few days.

However, the condition is discovered usually too late for any such attempt. Surgical opinion is again invoked at a later period when a degree of emaciation has already taken place, when solid food has, perhaps for long, been abstained from, and when fluids pass with difficulty. The dominating question is: "Will the patient's life be prolonged to a degree sufficient to warrant laparotomy for gastrostomy?"

The mode of death, as we have seen in our cases, has been following extreme emaciation with exhaustion or coma. It is evident, then, that if we can maintain the nutrition of the patient at a higher level a certain amount of relief can be given. Pressure symptoms from the esophagus are not in themselves a cause of death, nor have metastases been a prominent cause. Since a gastrostomy operation can be done with comparative simplicity and haste, and since alimentation can be readily instituted, gain in weight should be expected, and for a time considerable improvement anticipated. Life can probably be prolonged for two months or more, depending upon the promptness with which the operation is undertaken.

At the same time it is desirable to treat the patient with radium. Its efficacy has been amply demonstrated and methods of its introduction sufficiently simplified to permit of its use in every well-studied case. The radium in an ampule is introduced by means of a stomach-tube or small bougie and allowed to act locally. While radium will destroy cancer tissue in a dosage not affecting normal tissue, it, of course, will not cure the disease unless it is quite superficial or of a variety peculiarly susceptible to its influence. The destructive action of radium extends to a depth varying up to 9 cm., according to the dosage used and the sensitiveness of the neoplasm. This action, even to the depth mentioned, occurs with a maintenance of relative integrity of the normal tissue traversed. It should be used, however, only as a supplement, but not to replace the knife, except where the cancer is not amenable to operation, as in the location under discussion.

Feeding through sounds may be instituted early, perhaps with advantage, as later there is danger of a false passage through the esophagus, the tissue being more friable. However, some surgeons prefer feeding through a gastrostomy wound.

CLINIC OF DR. FREDERIC W. BANCROFT

SECOND SURGICAL DIVISION, NEW YORK HOSPITAL

OLD POSTERIOR DISLOCATION OF THE SHOULDER; CLOSED REDUCTION UNDER ANESTHESIA; REDISLOCATION, FOLLOWED BY OPEN OPERATION

THE patient is a man thirty-five years of age. His chief complaint is stiffness and inability to raise his left arm.

Past history is negative. Denies any epileptic seizures.

Present Illness.—Five weeks ago patient dreamed he was wrestling; fell out of bed. On awaking in the morning he was not certain whether he had fallen out of bed or whether he had dreamed this occurred. However, he had a swelling in the region of his left shoulder, stiffness around the shoulder-joint, and inability to abduct his arm. He consulted an orthopedic clinic, where he was treated for three weeks by electricity under the diagnosis of circumflex nerve paralysis.

Physical Examination.—As you can see, his arm is held closely to his side with a considerable degree of internal rotation. He is unable to abduct his arm without moving the scapula. On examination one can feel the head of the humerus immediately beneath the acromial process, and the anterior lip of the glenoid cavity can be felt in front. There is considerable atrophy of the deltoid muscle and also of the flexors and extensors of the arm. When he attempts to abduct the arm, however, it is possible to feel the deltoid muscle contract, thereby ruling out the diagnosis of circumflex nerve paralysis.

A stereoscopic *x*-ray (Fig. 744) shows the head of the humerus to be on the same level as the glenoid cavity, but immediately posterior to it, and also very clearly shows the internal rotation of the humerus.

Posterior dislocation of the shoulder is a relatively rare condition. It has been divided by most authorities into two types: subacromial and subspinal.

These two types are of degree rather than of different character. The subacromial lies immediately posterior to the glenoid cavity and is usually characterized by internal rotation and adduction, while the subspinal type is further back, lying beneath the spine of the scapula, and is usually characterized by an increased separation of the elbow from the side of the trunk.

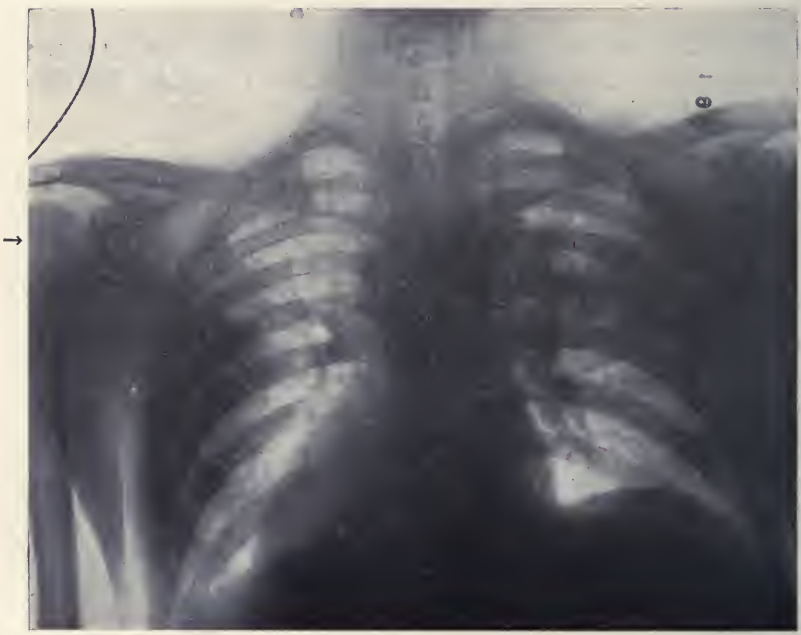

Fig. 744.—*x*-Ray picture showing posterior dislocation and internal rotation of humerus. Arm adducted close to side.

Stimson states that the common mode of production of posterior dislocation is pressure backward and outward upon the head of the humerus, either directly or through the elbow, combined with adduction of the limb across the front of the chest and internal rotation. Such a combination is most frequently found in falls forward, in which the weight is received upon the adducted elbow. It is possible to conceive that these factors might have entered in in this case, although the history is uncertain on account of the dislocation having occurred at night time when the patient was more or less asleep.

Two weeks ago, under ether anesthesia, the dislocation was reduced by first overcoming the muscle spasm by rotating the arm exteriorly and then drawing the head forward with countertraction on the scapula. The head was felt distinctly to slip into the glenoid cavity. As this was five weeks after the original dislocation, the capsule was undoubtedly remarkably relaxed due to the old tear, and it was easy, while the patient was under the anesthetic, to reproduce the dislocation. The arm was put in a Velpeau bandage and an *x*-ray two days later showed the head to be in place. On removing the bandage eight days after the reduction the head was found to have again become dis-

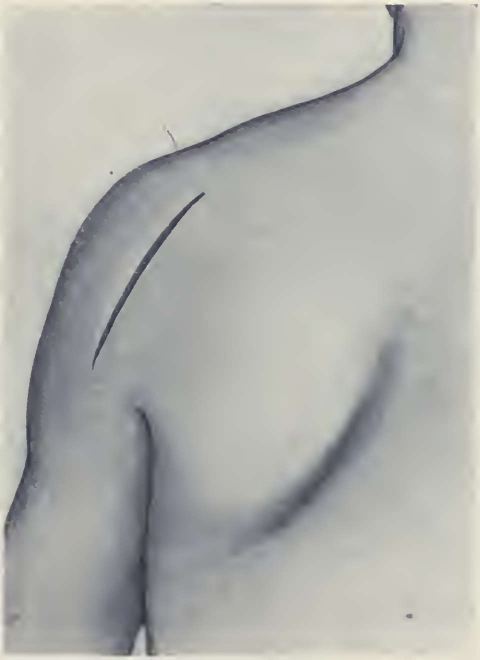

Fig. 745.—Open reduction of posterior dislocation of shoulder. Incision.

located posteriorly. For this reason an open operation was decided upon.

In looking up the literature on this subject I have been able to find very little about open operations for posterior dislocation of the shoulder. Anatomically it seems logical to assume that an incision posteriorly, with possibly the division of the infraspinatus muscle, will expose the joint capsule much more readily than can be done in cases of anterior dislocation operation.

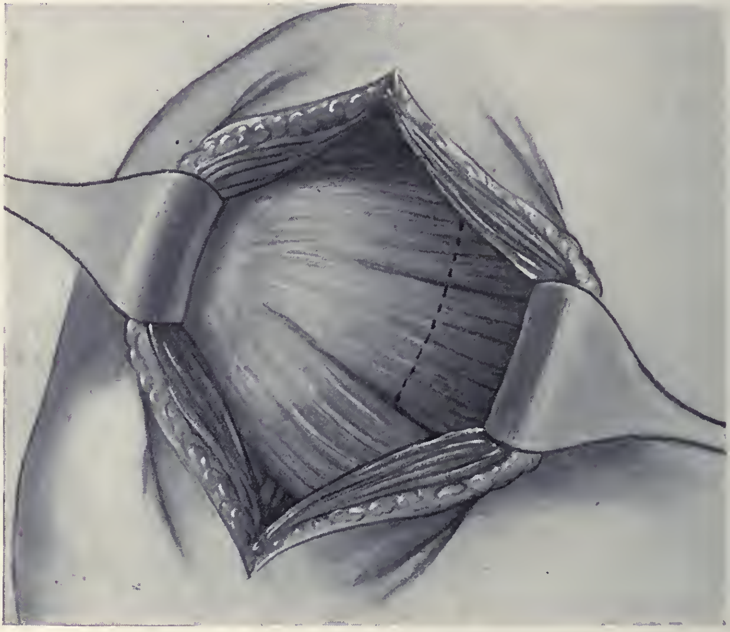

Fig. 746.—Posterior fibers of deltoid separated. Dotted line shows incision in infraspinatus muscle.

As you see, I am making the incision over the posterior surface and dividing the posterior fibers of the deltoid muscle. Care must be taken here to avoid the circumflex nerve. The infraspinatus tendon now goes directly across our field. We will divide this by putting in Pean clamps to identify the two ends of the muscle for future suture. The posterior portion of the capsule and the head are now directly in the field, but by traction with the aid of an assistant and by direct manipulation of the head I can now reduce it into the glenoid cavity, and you can see distinctly this large rent in the posterior surface of the capsule. There is now a choice of two procedures for us to adopt:

Either (1) to excise this portion of the capsule which is relaxed and suture the raw surface, or

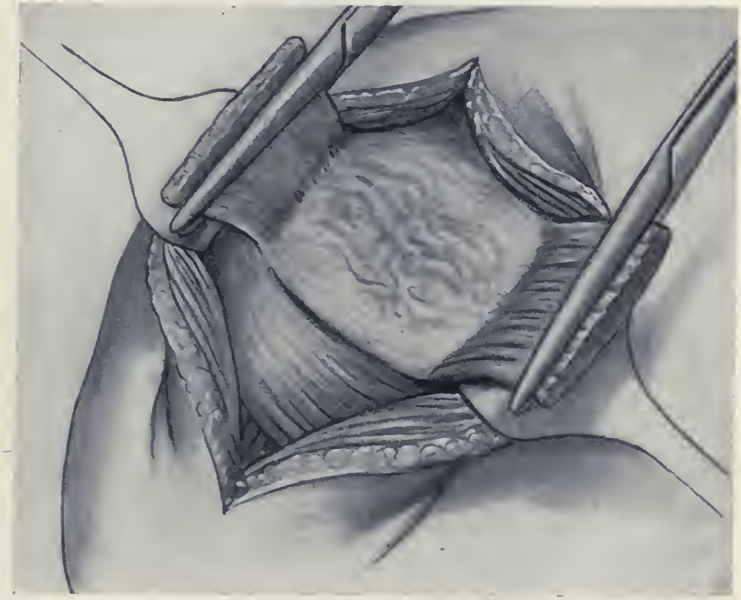

Fig. 747.—Infraspinatus muscle retracted. Rent in capsule shown.

(2) To repair this rent by reefing sutures and to repair the tear without opening the joint cavity.

Of these two procedures, the latter seems the safer, as I feel sure by freshening these surfaces we will gain union of the capsule, and adhesions in the joint are less likely to occur if we do not open it.

We have now inserted six mattress sutures which have taken up the slackness in the capsule and, as you can see, it is now taut.

We will now close our wound by suturing the infraspinatus tendon and uniting the fibers of the deltoid which were split longitudinally, the skin will be closed without drainage and the arm put up in a position of abduction 90 per cent. and extreme external rotation to relax the posterior capsule in order to allow healing to take place.

We have two contradictory factors here to fight. We must keep the arm mobilized long enough to allow the healing of the capsule, and yet we must start active motion and massage as soon as possible in order to prevent joint adhesions. For this reason I propose to keep him in an abducted position for about four weeks and then start gentle, active motion with massage.

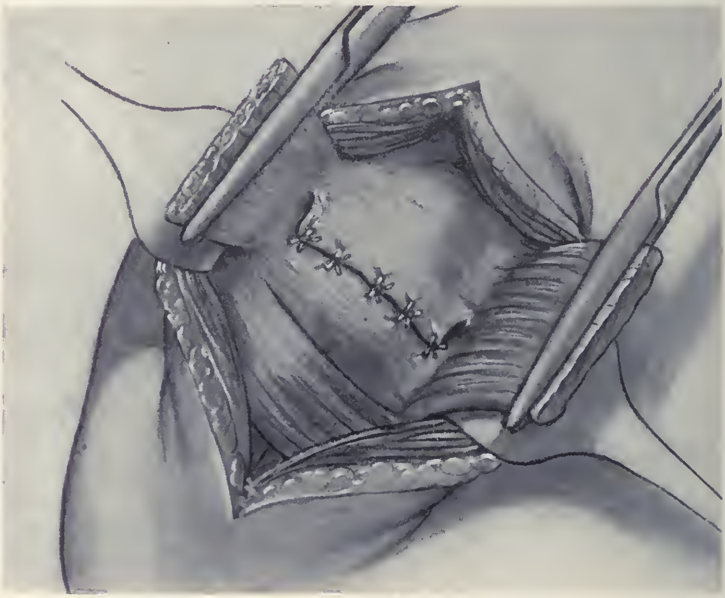

Fig. 748.—Head of humerus replaced in glenoid cavity. Rent in capsule sutured.

Condition Five Months After Operation.—Patient has no limitation of motion neither in external rotation nor in abduction, flexion, or extension. He has had no sign of subluxation of the joint since operation, and the atrophy of his muscles has completely disappeared. He thinks that the arm is a little bit weaker than his normal arm, but is able to perform his normal occupation.

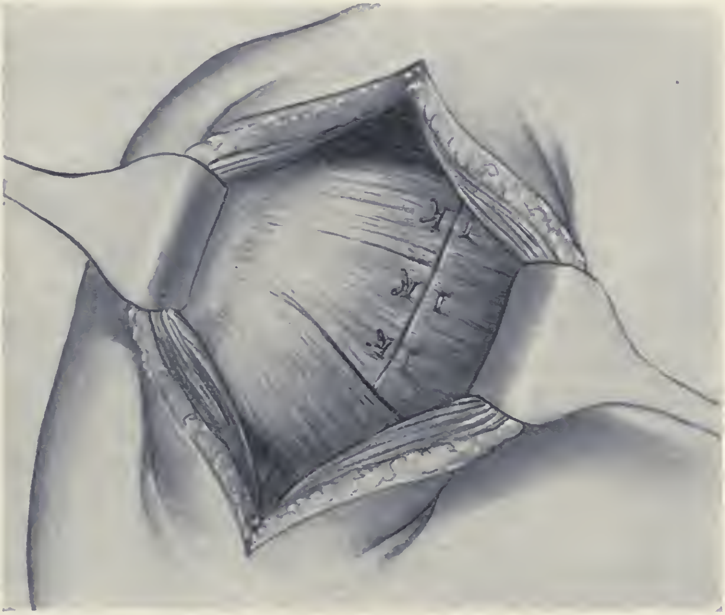

Fig. 749.—Infraspinatus muscle suture immediately before the suture of the deltoid and skin.

He will undoubtedly have to be careful for a certain period of time until this joint capsule is as strong as the other.

GIANT-CELL SARCOMA, LOWER END OF THE RADIUS

Curetage and Insertion of Mosetig-Moorhof Bone-wax. Recurrence One Year Later. Curetage and Insertion of Radium. Formation of Secondary Osteomyelitic Cavity with Marked Radial Deviation, Resection of Lower End of Radius and Ulna.

I WISH to present this case to you because it is now four and one-half years since the first operation, and it brings up many problems connected with giant-cell sarcoma of the long bone.

The patient is twenty-eight years of age, female, single; occupation clerk. Admitted to the New York Hospital on June 10, 1917. Her chief complaint was a swollen and painful right wrist.

Present Illness.—Two and a half months ago the patient fell and sprained her wrist, but during the following week there was no pain. Then the wrist became tender on pressure. The tenderness gradually became worse and the patient's doctor, thinking the infection came from an abscessed tooth, obtained a culture from her tooth and gave her serum treatment. There was no improvement. About three weeks ago she fell against the window of a car and dorsally flexed her wrist, which resulted in excruciating pain. The terrific pain continued. An *x*-ray was ordered by her physician and it showed a blur on the lower end of the radius. She was then referred to the hospital.

Past history is negative, with the exception that two years ago she suffered for two to three weeks from otitis media, and that she has had several abscesses of her teeth during the past year.

Family history negative.

Her surgical condition shows a swollen and reddened wrist which is very tender, especially over the prominence of the radius and ulna posteriorly. There is scarcely any flexion in the wrist-joint and very slight flexion of the fingers. There is no crepitation and only a brawny induration over the head of the radius posteriorly.

Pathologist's Report.—Wassermann negative. Blood count, W. B. C., 14,520. Differential polymorphonuclears, 54 per cent.; small lymphocytes, 33 per cent.; large lymphocytes, 3 per cent.; large mononuclears, 9 per cent.

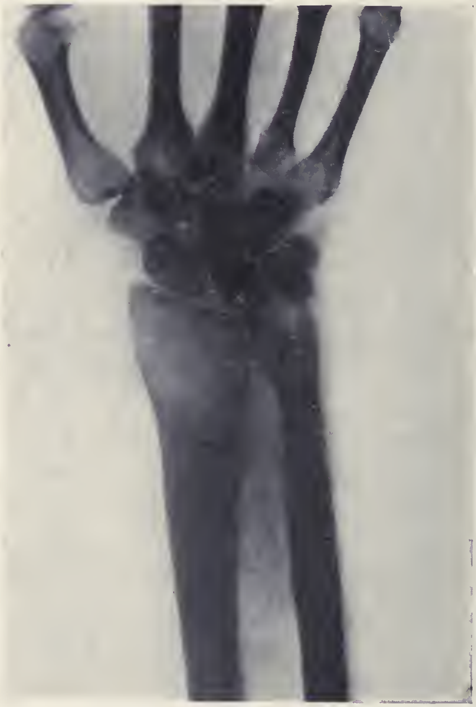

Fig. 750.—*x*-Ray of giant-cell sarcoma. Head of radius, marked rarefaction of end of shaft. Very little new bone production.

x-Rays (Fig. 750) show marked rarefaction of the lower end of the radius.

Operation (June 4, 1917).—A long incision, 7 cm., was made over the dorsal surface of the radius. The extensor tendons were retracted. Dissecting through these tendons a considerable amount of seminecrotic material escaped through a small hole in the radius. This opening was enlarged and a cavity was found in the head of the radius about 5 x 2 cm. and extending almost to the articular surface. This had a smooth wall which did not bleed. A small rupture had apparently taken place on the anterior surface. A considerable amount of a grayish material was cureted out. The cavity was then filled with Mosetig-Moorhof bone-wax. The tendons and fascia were sutured over the defect and the wound was closed without drainage. Anterior molded splint was applied.

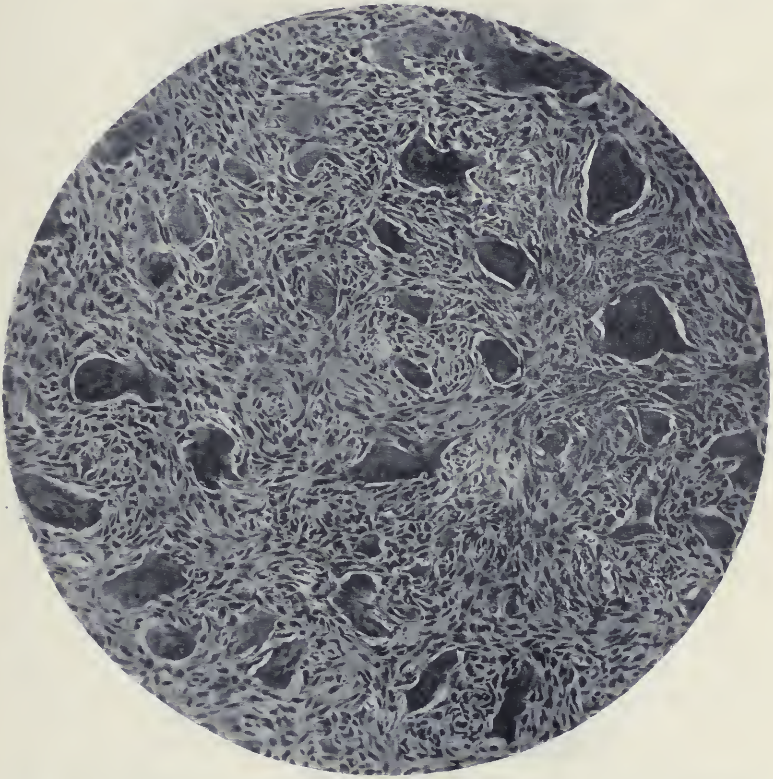

Fig. 751.—Photomicrograph of material removed from cavity in head of radius. Shows giant-cells and rather an active struma of the epulis type.

Wound healed with primary union.

Subsequent Admission (April 2, 1918).—Following her discharge one year ago patient had baking and massage for three months. Pain disappeared and after five months she went back to work. She has had no pain, but has noticed recently that the wrist is beginning to swell again (Fig. 752).

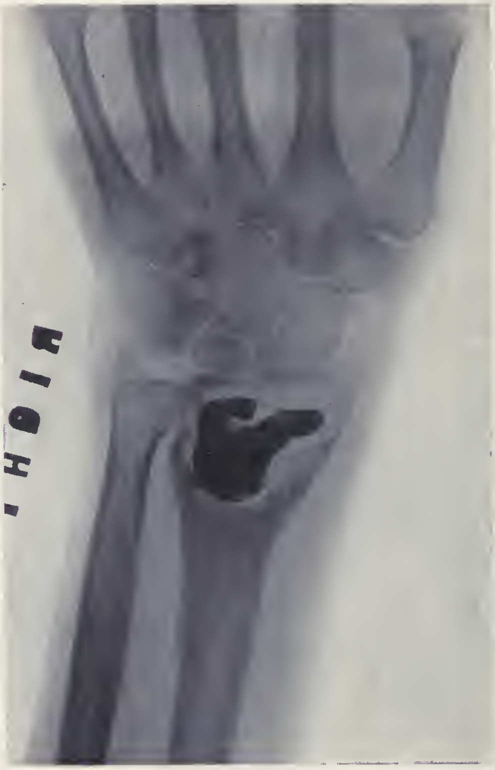

Fig. 752.—Giant-cell sarcoma showing result after first operation. Dark area is bone-wax. November 25, 1918.

Examination at this time revealed the old scar over the dorsal of the right wrist, a diffuse swelling over the lower end of the radius. This was fusiform in shape, and bulging on all sides was seen on inspection. There was no redness or fluctuation. There was tenderness over the end of the radius. There was limitation of wrist-joint motion in all directions, but no ankylosis. No limitation of motion of the fingers. No other bone deformities of the extremities detected.

Operation (April 3, 1918).—The same incision was adopted as at the former operation, and a reddish tumor mass was found projecting from the radius about 0.5 cm. This mass was excised and the cavity in the radius opened. The cavity was filled with a mixture of bone paste and a reddish, friable, pulpy mass that grossly appeared like a giant-cell sarcoma. This was cureted out entirely. It was observed that there was a small perforation on the anterior surface of the radius. The cavity was swabbed out with pure carbolic acid and hemostasis obtained; three cylinders, one containing 50 mm., and two, each containing 25 mm. of radium, were then inserted into the cavity. The remainder of the cavity was filled with bone-wax. The fascia and tendons and skin were united with the exception of a small hiatus through which the radium could be removed. The radium was left in place for five hours. Patient left the hospital on the sixth day postoperative.

Subsequent history was that a small sinus occurred on the dorsum of the wrist. This discharged a small amount of purulent material mixed with bone-wax. The patient was then treated by a radiologist, but developed an extensive *x*-ray burn so that her hand had to be kept in extension for several months. She was treated in another hospital and amputation advised, but she refused.

Subsequently, on my return from the Army, I saw her, and she then had a persistent sinus with marked radial deviation of the hand due to the collapse of the cavity from a secondary osteomyelitic process (Figs. 753, 754).

The *x*-rays showed no signs of recurrence of the growth. There was, however, marked limitation of the flexion of the fingers due to the atrophy from the long period of disuse when the hand was kept in a splint.

As the *x*-ray showed a small osteomyelitic process in the lower end of the ulna (Fig. 753, *B*), it was thought advisable to do a resection of the lower end of the radius and ulna. It would, of course, have been preferable to have resected an inch of the ulna higher up and then forced the lower end of the ulna upward in order to maintain the styloid process, but this seemed inadvisable due to possible infection of the lower end.

Under anesthesia about 1½ inches of the lower radius and ulna were resected. The wound was Carreled for about one month and the wound closed without any sinus. At that time she had pronation and supination through an arc of about 45 degrees, but was able only to flex her fingers so that there was a separation of about 1 cm. between the thumb and the

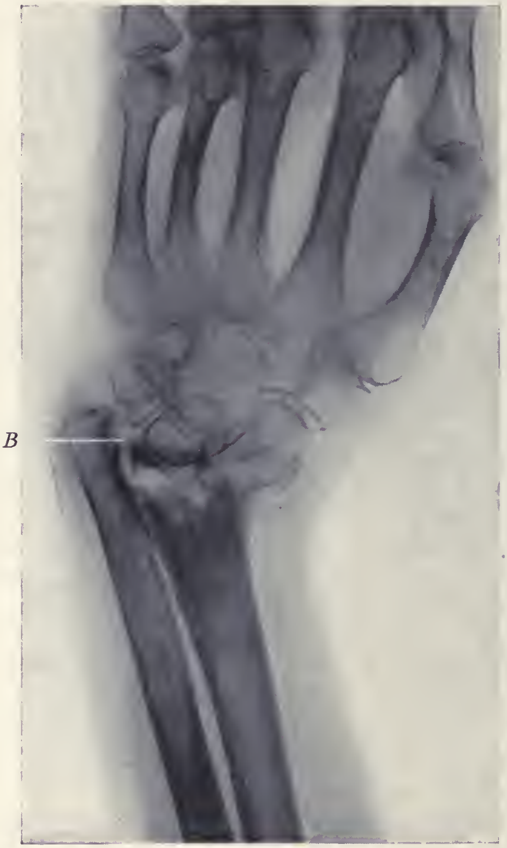

Fig. 753.—December 3, 1919. (See Case XI.)

tip of the index-finger. On attempting active flexion of the fingers a marked anemia was shown over the scar on the dorsal surface so that it seemed evident that there were marked adhesions between her dorsal tendons and the skin.

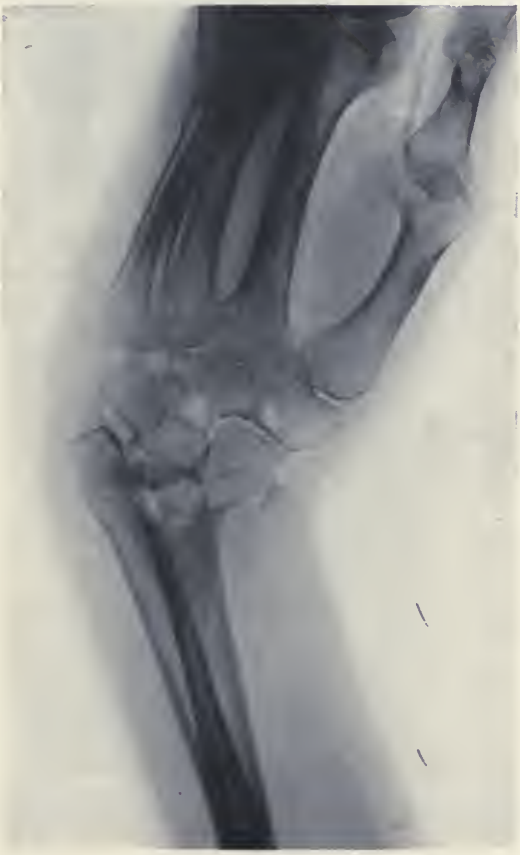

Fig. 754.—*x*-Ray December 3, 1919. Collapse of osteomyelitis cavity with marked radial deviation of hand and some anterior dislocation.

On May 2, 1921 a fourth operation was done, excising the old skin and scar tissue over the dorsal of the wrist, the tendons were dissected free and a fat transplant from the abdominal wall was placed about the tendons, and the defect closed by a pedicle skin-flap taken from the forearm. The lower portion of the graft sloughed, but the fat remained in place. She is now able to grasp objects with her thumb and fingers, but is not able completely to flex her fingers. This is partly due to a partial ankylosis at the metacarpophalangeal joints due to the long period of immobilization. She is able to perform her work and is without pain.

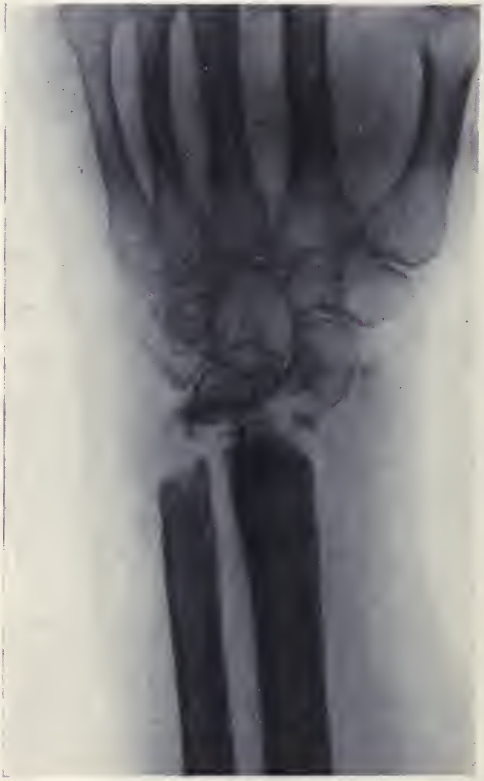

Fig. 755.—January 29, 1920. (See Fig. 756.)

This case is presented because the primary tumor was of a type slightly more malignant than the usual giant-cell sarcoma in that the stroma about the giant-cells showed a more active process. While her result at the present time is not a complete functional cure, it is very much more satisfactory than an artificial hand would be, and as four and a half years have elapsed, it seems reasonable to assume that there will not be a recurrence. The *x*-ray, as you see, shows a slight anterior dislocation of the wrist, but she is able to drive a car, swim, and perform her ordinary duties and earn her living.

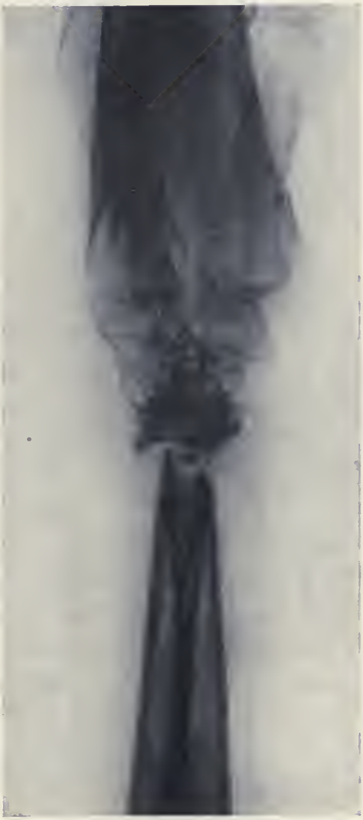

Fig. 756.—*x*-Ray after resection of lower end of radius and ulna. January 29, 1920.

TWO CASES OF ACUTE HEMATOGENOUS OSTEOMYELITIS OF THE FEMUR

Case I.—Boy of ten years.

Admitted September, 1920. Chief complaint, throbbing pain in the left knee for four days and stiffness of the left knee, following a blow to the knee against a stone.

Present History.—Four days ago while playing baseball child struck his left knee against a stone which was being used as a base—"was sliding to the base." The next day the knee began to swell slightly and began to throb. He was unable to put his foot to the floor without pain in the region of the knee-joint. Became unable to bend the knee without intense pain. Condition became progressively worse up until the time of his admission to the hospital.

Child was admitted to the hospital with a temperature of 104° F.; pulse 120, respiration 24. White blood count was 22,100, with 87 per cent. polynuclears.

Physical Examination.—Patient lies in bed with the leg rotated outward and flexion of the knee about 30 degrees. Complains of pain on motion of the knee. There is marked tenderness about the knee and the lower end of the femur. The maximum point of tenderness is on the inner side in the region of the internal condyle of the femur and posteriorly in the popliteal fossa. Deep and continuous pressure over the femur higher up causes excruciating pain. There are several large and tender inguinal nodes. There is a small elliptic abrasion over the internal malleolus of the tibia.

The *diagnosis* of osteomyelitis of the metaphysis of the femur was made on account of the history, and the fact that while there was fluid in the joint the main tenderness was in the region of the lower epiphysis of the femur. The *x*-ray (Fig. 757) shows a slight fuzziness posteriorly in the region of the epiphysis.

Operation.—A long incision of the lateral surface of the thigh. Periosteum in the lower third of the femur was stripped from the bone and contained about 2 ounces of pus. On palpation the bone felt roughened externally. On account of the extreme prostration of the patient it was thought advisable to explore the medullary canal. Two burr holes were therefore made along a supracondylar ridge. From the lower one bloody serum with some broken-down fat escaped under tension. As the abscess cavity pointed toward popliteal space it was thought advisable to drain in that region. A small longitudinal incision was made and a tube inserted. Carrel tubes were inserted in the

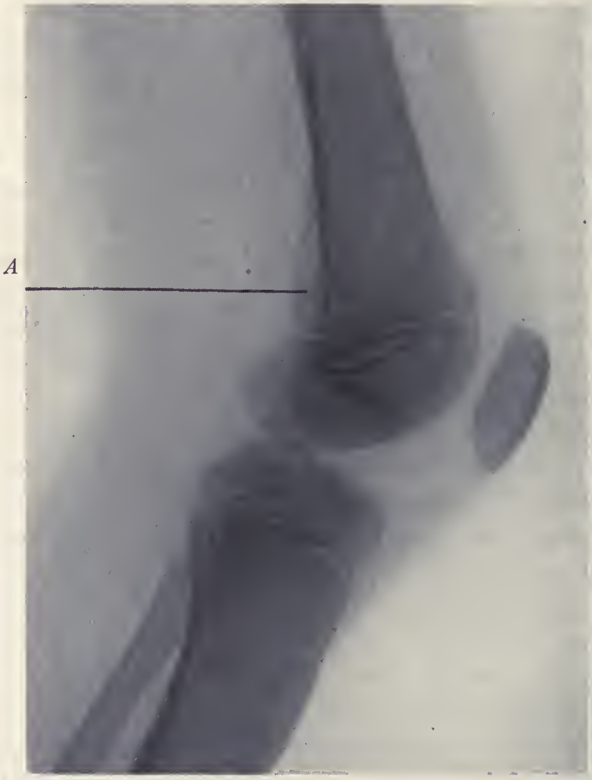

Fig. 757.—Case I. Acute osteomyelitis of femur: *A*, Definite area of rarefaction in posterior portion of metaphysis. October 22, 1920.

lateral wound. There was some swelling of the knee-joint for a considerable time, but this gradually subsided without treatment. The wound was Carreled. The boy left the hospital on the forty-fourth day. The *x*-rays at this time showed considerable proliferation about the lower end of the femur (Fig. 758) and suggests a possible sequestrum. However, from my

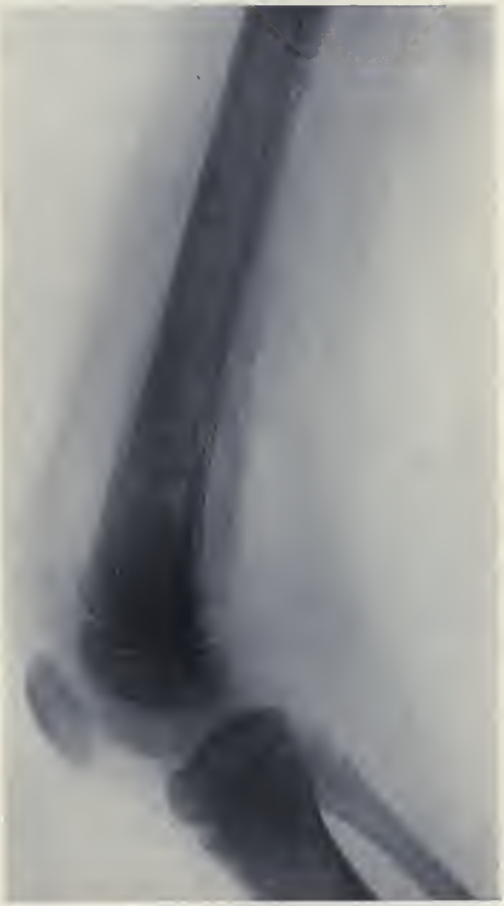

Fig. 758.—Lateral view November 3, 1920. Marked subperiosteal and extraperiosteal bone proliferation. Operative burr holes seen. *x*-Ray suggests beginning sequestration.

experience in previous cases I feel that frequently bone that appears necrotic in the x-ray will in children become reorganized,

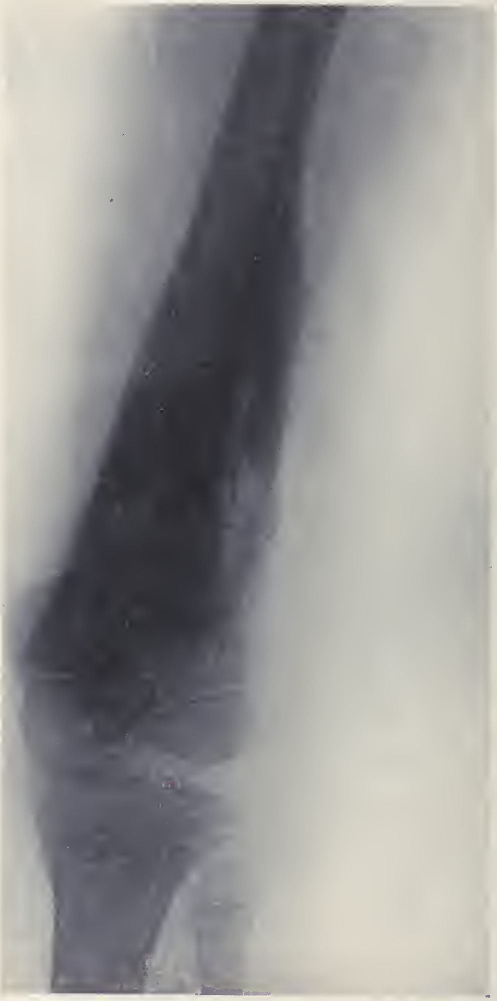

Fig. 759.—February 7, 1921. Continuation of process suggests small cortical sequestrum. In this case, however, child is running around, feels perfectly well, and has had no sign of a sinus since operation.

and that if the child is progressing well clinically it is favorable to wait for a considerable period of time.

Follow up (November 17, 1921): Wound completely healed for over a year. Runs and plays without pain. Examination shows linear scar, no bone tenderness or induration, no limitation of motion of the knee-joint (Fig. 759).

Case II.—Girl seventeen months of age.

Chief complaint tenderness of left thigh.

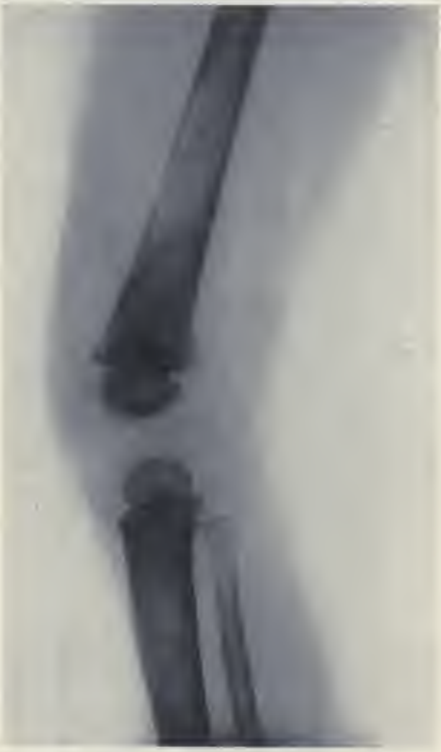

Fig. 760.—June 10, 1921. Ten days postoperative. Shows some rarefaction.

Present Illness.—Three days before admission child became fretful and feverish. Parents took her to a doctor, who immediately referred her to a hospital. The baby appeared acutely ill, and on admission to the hospital had a temperature of 104.2° F., pulse 120, respiration 36. White blood count was 20,000, with 91 per cent. polynuclears.

Operation.—Incision was made over the entire length of the left thigh. There was marked edema of the muscles, but in cutting through the deep fascia a large abscess cavity was opened which completely surrounded the femur and was largely

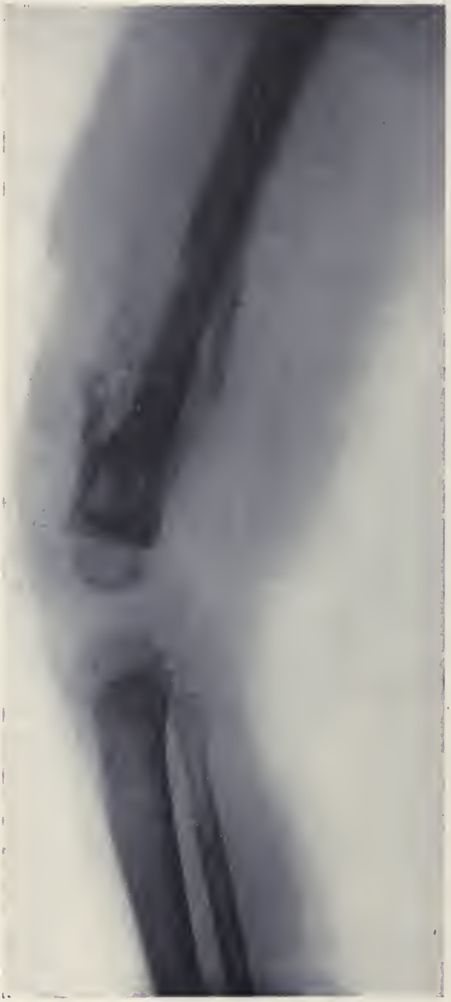

Fig. 761.—Case II. *x*-Ray July 2, 1921. Shows area of operative interference and considerable subperiosteal bone proliferation.

extraperiosteal. The periosteum was scraped back over the lateral surface of the lower third of the femur. With a drill a small hole was made about 4 inches above the lower end. Pus escaped from the medullary cavity. A similar opening was

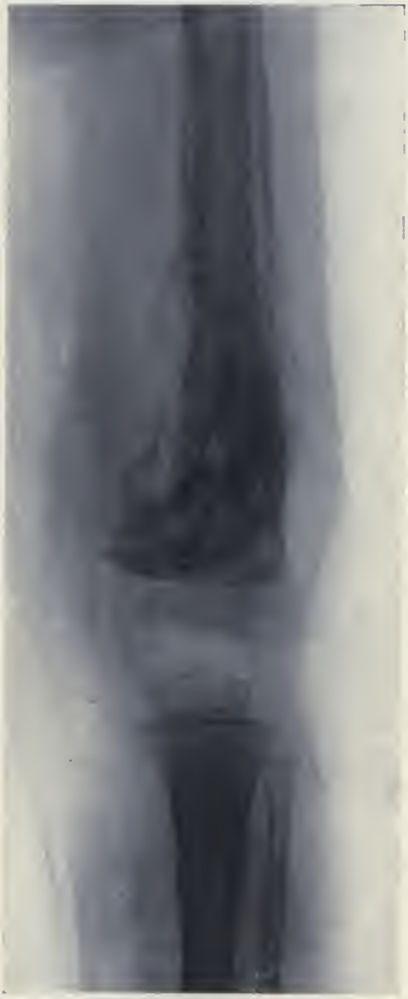

Fig. 762.—Case II. July 27, 1921. Marked subperiosteal bone proliferation. Appearance somewhat suggests beginning sequestrum formation.

made 1 inch distal, from which pus also escaped. With a gouge the medullary canal was opened between these two holes and a considerable amount of broken-down tissue was removed from the canal without cureting. A counter stab wound was made on

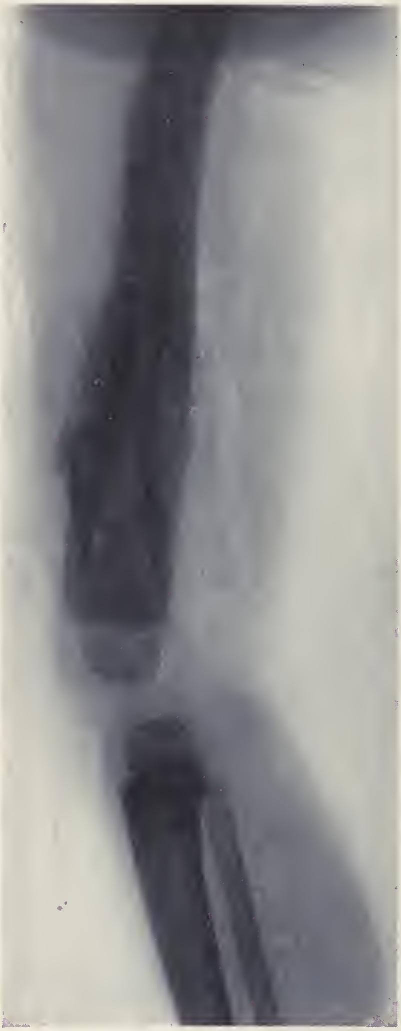

Fig. 763.—Case II. September 19, 1921. Marked subperiosteal bone production. No sign of sequestrum. General condition satisfactory.

the mesial surface below the extensor tendon. Carrel tubes and Dakin gauze were inserted along the side of the femur, but none were placed in the medullary canal.

Culture showed a pure growth of Staphylococcus aureus.

Child was discharged from the hospital on the sixty-fourth day, with a normal temperature. The incision was completely healed, but there was a small sinus from the mesial stab wound.

Three months after discharge a forceps was inserted and a small cortical sequestrum removed (Fig. 763). As you can see by the intermediary plates, there has been marked reaction and new bone production. I am convinced in this case that if the femur had been opened widely and packed an entire sequestrum of the shaft would have occurred.

The wound has now closed completely.

In the treatment of osteomyelitis in children I believe we have entirely different factors to deal with than in the treatment of osteomyelitis in adults, and for this reason I believe that a word of caution is advisable in regard to conservatism as contrasted to the radicalism necessary in osteomyelitis in adults.

In children the bone is much softer, the circulation is better, and the tendency for osteosclerosis is less. Moreover, we have to use extreme caution not to injure the epiphysis.

As Lexer has so graphically shown (Fig. 764) with radiograms, by injecting the arteries with substances resistant to the *x*-ray, the diaphysis, with the exception of the circumferential lamellæ, is almost entirely supplied through the nutrient artery. The epiphysis and neighboring portions of the metaphysis receive an abundant blood-supply from the numerous metaphyseal arteries. Therefore, in any treatment of acute osteomyelitis in children we must be extremely careful not to traumatize the medullary canal.

The problem is of the same general surgical principles as pus elsewhere in the body, that is, relief of pus under pressure. This may be accomplished either by making burr holes into the humerus, or by removing as much of the cortex as may be necessary to promote adequate drainage. Packing and cureting of the medullary cavity should be avoided. If it is practicable.

I believe the best method is to lay Carrel-Dakin tubes in the

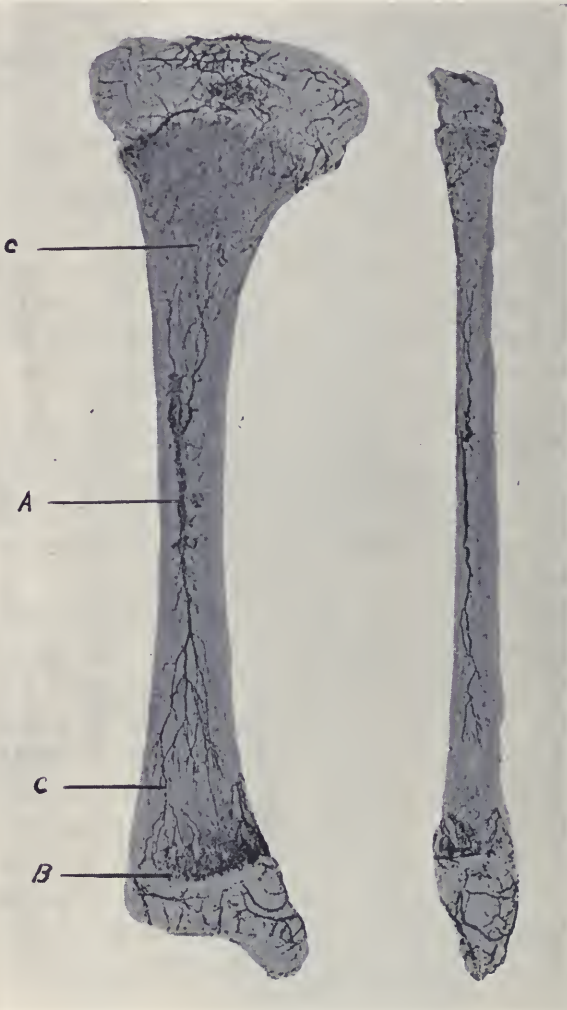

Fig. 764.—Circulation of infant's tibia and fibula (after Lexer): *A*, Nutrient artery; *B*, metaphyseal and capsular arteries; *C*, relative avascular zone where sequestrum separation usually occurs.

immediate vicinity of the shaft, and, if possible, between the periosteum and the shaft. This will allow thorough bathing of the infected field with a solution as described by Carrel without injuring the blood-supply.

You will find if this method is carried out carefully that the formation of sequestra can very frequently be avoided and the long hospital stay greatly shortened. Moreover, deformity will frequently be prevented.

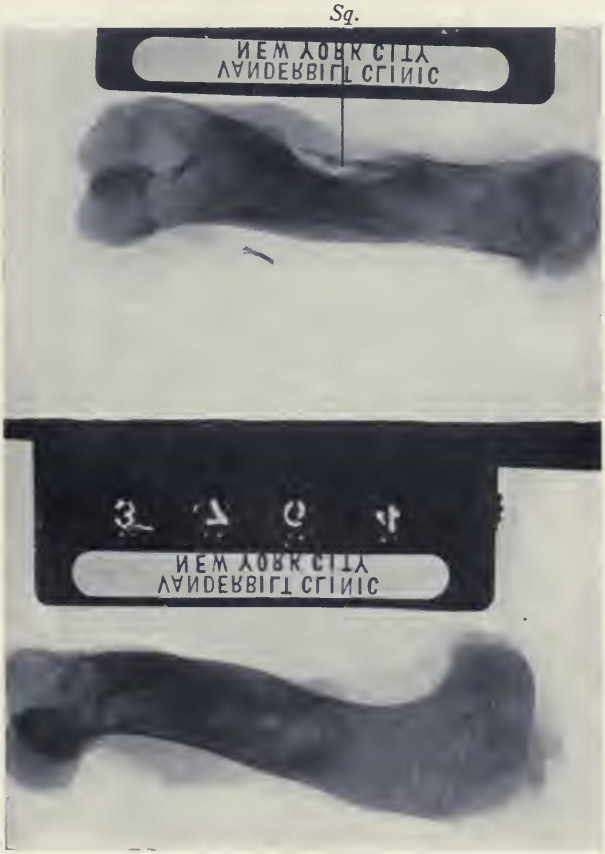

Fig. 765.—Osteomyelitis in dog. Injection of Staphylococcus aureus in the medullary canal: *Sq.*, Cortical sequestrum. Marked new bone production tending to wall off medullary canal and compensatory subperiosteal bone proliferation on the opposite side.

In a series of experiments carried on in the Laboratory of

Surgical Research at Columbia University[1] I was able to show that a sterile sequestrum produced by a chemical irritant, such as croton oil, was later reorganized so that by *x*-ray and gross examination we were unable to detect its former outlines. I believe that this condition frequently occurs in children. In the series of cases that we have had at the New York Hospital we have had 2 cases where bone either by *x*-ray or by gross examination appeared dead, but later *x*-rays showed this bone

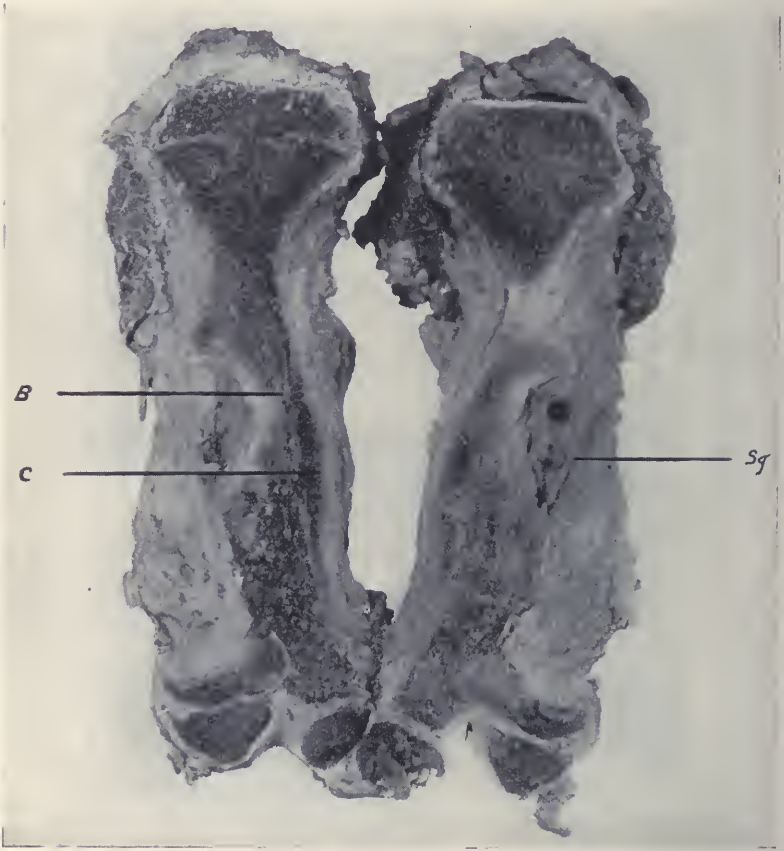

Fig. 766.—Photograph of cross-section: *Sq.*, sequestrum; *B*, rarefied cortex; *C*, subperiosteal bone proliferation.

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[1] Annals of Surgery, May, 1921.

to be incorporated with living bone and to all appearances it was healthy.

Figure 765 shows the process following the production of osteomyelitis in a dog by introducing a strain of Staphylococcus aureus that had been obtained from a case of osteomyelitis in a human, and then transmitted through a dog and later injected into the medullary canal of the humerus in a second dog.

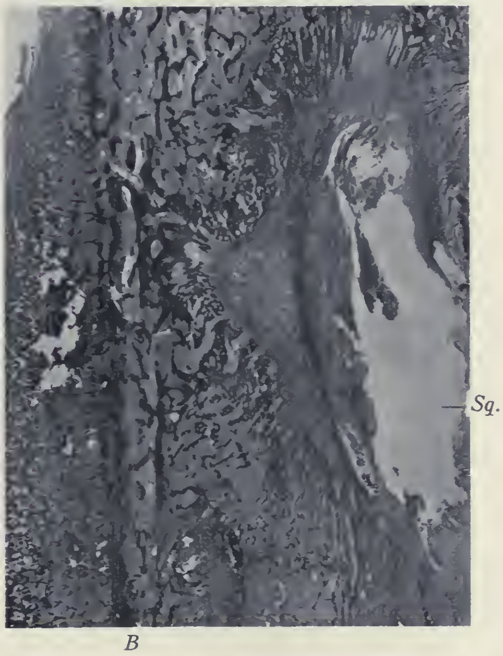

Fig. 767.—Low-power photomicrograph: *Sq.*, Cavity in which sequestrum shows granulation tissue with new bone production in the medullary canal; *B*, rarefied cortex surrounded by areas of leukocytes and infected granulation tissue. (Compare with Fig. 766.)

In these experiments we exposed the humerus, attempting to destroy the nutrient artery and vein by stripping the periosteum from the posterior surface, then made a burr hole into the medullary cavity, inserted a small piece of gauze soaked in bouillon culture of staphylococcus into the medullary canal, plugged the hole with bone-wax, and then sutured the muscles and skin.

Several of the animals died immediately, showing all the reactions of an acute staphylococcus pyemia, acute osteomyelitis of the humerus, multiple infarcts of the kidney, and occasionally of the spleen. Several of the animals, however, resisted the acute infection, and we were able to study the process of chronic osteomyelitis. One animal (Fig. 765) lived for two months with a sinus discharging pus. As you can see by the x-ray, he developed a cortical sequestrum.

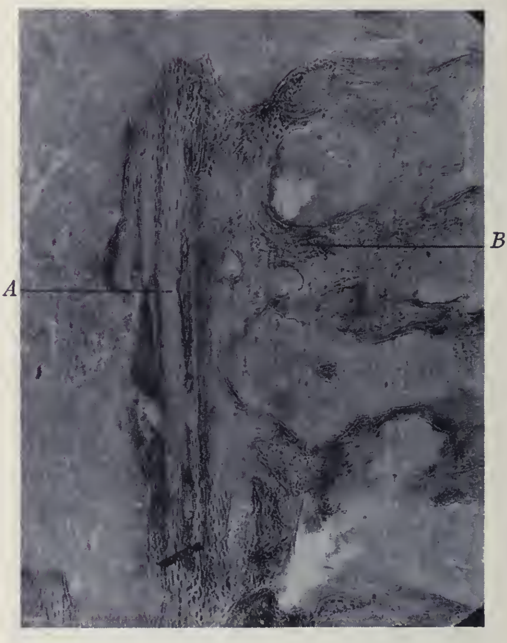

Fig. 768.—High-power view of rarefied cortex of bone in Fig. 766, *B*. Shows necrotic bone surrounded by new living bone growing in the presence of an infection. It is reasonable to assume that as the infection subsides this bone would not be thrown off as a sequestrum, but would gradually become reorganized: *A*, Necrotic bone with absence of bone nuclei; *B*, living subperiosteal bone.

It is also interesting to note in the cut section (Fig. 766) the reparative process showing the formation of new bone in the face of an infection, attempting to wall off the remainder of the medullary cavity. You will also notice (Fig. 767, *B*) the marked rarefaction of the cortex opposite, or distal, to the sequestrum. Peripheral to this rarefied cortex there is a subperiosteal formation of new bone. If we observe closely this area under the high power (Fig. 768) we will see that the cortex is in many places necrotic. The nucleæ of the bone-cells are absent from the lacunæ, but it is interesting to note that around these areas of dead bone there is new bone formation occurring in the presence of infection as is shown by the pus-cells and infected surrounding granulated tissue.

It is reasonable to assume that these areas of dead bone will not be thrown off as sequestra, but with the gradual overcoming of the infection they will become reorganized and act very largely as bone-grafts.

From the knowledge gained from these experiments I am inclined to believe that a similar process frequently occurs in children, and for this reason we should be guided by conservatism in the treatment of chronic osteomyelitis in children where clinically the case is progressing favorably, although *x*-rays or gross examination suggest the presence of necrotic bone. By carrying out this procedure frequently we will be able to hasten convalescence and avoid deformity. I am convinced from our present knowledge of osteomyelitis in children that it is inadvisable in general to attempt to remove an entire shaft in the early treatment of acute osteomyelitis, as has been advised by some surgeons, for occasionally regeneration of new bone does not occur and we are faced with the problem of either marked deformity or secondary operations necessitating bone-grafts.

TWO CASES OF LOCALIZED BONE ABSCESS (BRODIE'S ABSCESS), ONE CASE OF OSTEITIS FIBROSA CYSTICA, AND ONE CASE OF CHRONIC TRAUMATIC OSTEOMYELITIS

I AM presenting these cases to you because they illustrate various methods of closing the dead space so common following localized infections in bone.

Case I.—A woman thirty-eight years of age. Admitted April 22, 1920. Her chief complaint was a swollen, painful right leg immediately above the knee on the posterior surface. Duration of one month.

Present Condition.—About three months ago, without any previous history of trauma, patient began to have pain in the right leg immediately above the knee. At that time she had chills and fever. Says she did not notice any red swelling on the back of the leg until one month ago. She has lost weight and has felt weak and unable to be about for the past three weeks.

Physical Examination.—Mouth shows a few teeth which are decayed. The gums appear to be normal. The examination is otherwise negative except for the surgical condition.

Over the lower posterior aspect of the right thigh was a large zone of induration, swelling, and tenderness. Near the center of this the skin is red and swollen. The swelling is soft and gives a sense of fluctuation. The femur itself is distinctly tender anteriorly and posteriorly over its lower half. The knee-joint is not involved and there are no tender or enlarged inguinal nodes.

Operation.—Incision, drainage, and osteotomy for localized osteomyelitis of the right femur. The femur was approached from a lateral aspect. Muscles were split longitudinally and retracted. About the junction of the middle and lower third of the femur on the posterior external surface there was seen an area about 1 cm. in diameter over which the periosteum was absent. There was a small cloaca in the center. The bone was chiseled away in the region of this abscess and an abscess cavity of small size was seen in the bone. The bone surrounding this abscess cavity was densely sclerosed and was chiseled away with difficulty. The abscess was thoroughly cureted and irrigated with ether. Counterdrainage was then made over the posterior aspect of the thigh in the most dependent portion of the subcutaneous abscess. Carrel tubes were placed down to the bone and in the subcutaneous tissue and muscle. The fascia lata was split transversely so as to avoid occlusion of the drainage tract when the leg was extended.

The Pathologic Report of the Material Removed by Curet.—Microscopically the material consisted of the elements of a chronic progressive inflammation. There is much new connective tissue infiltrated with lymphocytes and plasma-cells. Culture shows a pure growth of Staphylococcus albus.

Patient was placed on Carrel technic and left the hospital on the forty-third day postoperative. At that time the main wound was completely healed and the counterdrainage wound was discharging a slight serum. She was able to walk without crutches and to reflex her knee to a right angle.

Follow up (April 10, 1921): Wound completely healed, walks without a limp, has no complaints. Examination: No limitation of motion, no sinus, no tenderness, no bone thickening, and no depression of scar.

Case II.—Woman aged twenty-five. Admitted May 13, 1920. Chief complaint enlargement of the right leg just below the knee. Duration of seventeen years.

Present Condition.—Patient says that when she was about eight years of age the leg became swollen in the region of her present lesion. It was somewhat painful. This pain, however, did not persist long. In recent years it is only painful during bad weather. The pain is not severe and it does not interfere with function. It is not tender on pressure.

Physical examination negative, except for the surgical condition. A moderate round swelling persists over the anterior aspect of the upper third of the right tibia. It is hard, not tender, and seems to be in the bone. There is no tenderness either proximately or distally over the tibia and no involvement of the knee-joint.

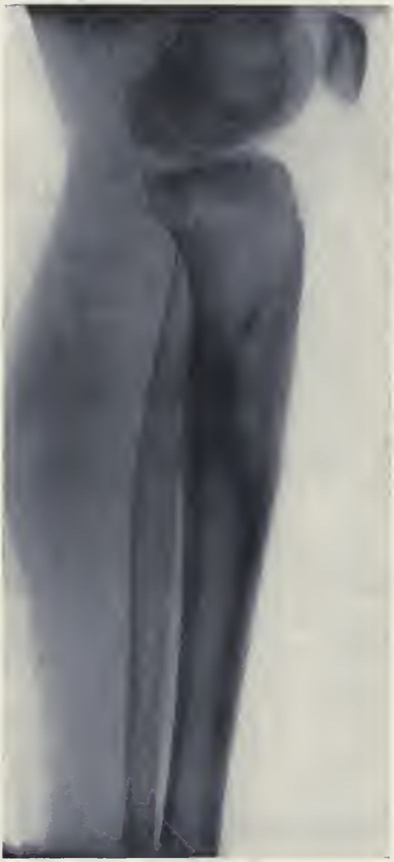

Fig. 769.—September 24, 1920. Postoperative result of bone abscess, Case I. Shows chiseling away of walls of cavity so that it is possible for the soft parts to fill in, obliterating the dead space.

Operation.—Osteotomy for bone abscess May 14, 1920.

Vertical, oval incision with a convexity toward the mesial surface. Periosteum was exposed. The periosteum was densely adherent to the bone, swollen, with small irregular elevations. The periosteum was scraped off, was very thick, and a small cavity about 1 cm. containing thick pus was chiseled into in the region of the medullary canal. The bone surrounding this was ebony in consistency and chiseled with difficulty.

The overhanging walls were then shelved off. The cavity was cureted. The periosteum was resutured across the bone, leaving a stab wound for the admission of four Carrel tubes. Skin and subcutaneous tissues were closed, allowing exit for the Carrel tubes.

Culture shows a pure growth of Staphylococcus aureus.

Patient left the hospital on the sixteenth day. There was a small granulating area, but no deep tract.

Pathologic report showed a chronic sclerosing osteitis; section of the decalcified, thickened bone trabecula without any inflammatory exudate.

April 3, 1920: Patient walks without a limp. Discharge ceased three weeks after leaving the hospital. Examination: Wound completely healed. No bone tenderness, no swelling, and the scar is not tender.

Case III.—A man aged twenty-five years. Admitted April 23, 1919. Chief complaint abscess of right lower leg.

Present History.—While a school boy in Armenia fifteen years ago he noticed redness and swelling about the ankle. Says he had a fever, but does not remember any cause for this condition, which kept him out of school for a year. He was in bed for some time and then went about with only slight disability. Swelling, however, persisted and pain was present, usually after being on his feet for long periods.

About nine years ago the abscess broke and a small piece of bone came out. Remained closed then for four years.

For the last three years there has been an intermittent discharge of a thin, watery, yellowish fluid. Frequently closes during winter and becomes open during the summer. There has never been any impairment of motion in the ankle. Otherwise his general condition has been good.

Physical examination negative except for the surgical condition. Tissues over the lower aspect of the right tibia are very much thickened and indurated. A small inner healed scar is seen over the inner aspect just under the outer aspect of the internal malleolus. A puckered, small, irregular, loosened area is seen on the anterior surface of the leg between the region of the tibia and the fibula. A small sinus here is oozing a thin, serous exudate. The lower end of the tibia seems definitely thickened and the overlying tissues here are adherent in places. The normal motions of the ankle-joint are considerably impaired and forced passive motion causes some discomfort.

Wassermann negative.

Urine negative for Bence-Jones' protein.

x-Ray diagnosis is osteomyelitis of the lower shaft of the right tibia (Fig. 770).

On April 26, 1919 Dr. Pool operated. Periosteum was separated from the bone through a 6-inch incision, the anterior surface and considerable of the lateral surface were removed with chisel and rongeur. Bone was markedly sclerosed and a definite abscess cavity was entered in the region of the medullary canal. Carrel tubes were introduced.

Tissue removed from the abscess cavity showed on microscopic examination the presence of dense fibrous tissue heavily infiltrated with plasma-cells which were so numerous as to suggest a *plasma-cell myeloma*, not an abscess. These findings suggest osteitis fibrosa cystica.

Culture.—The abscess cavity showed a pure growth of Staphylococcus aureus. The wound was then Carreled for sixty-six days.

When smear was last taken it showed about 4 cocci to a field.

On July 1, 1919 I removed from the left leg through a curved incision a piece of the tibia about 0.5 x 4 cm. and about 2 mm. in thickness. This piece was placed on a dry sponge and the wound was then closed. The skin was excised about the cavity in the right tibia and the granulations cureted. The piece of bone removed was then cut up into small fragments about 1 to 2 mm. in diameter, and these were placed in the cavity of the bone. As the skin layer in this region was thin, due to former scars, and as it was impossible to draw a satisfactory flap over this region, it was thought advisable to first bridge over the cavity with a fascia lata transplant, in order to prevent direct contact of the bone-chips lying in blood-clot with a traumatized skin. An incision was therefore made in the left thigh and a fascia lata flap with the surrounding fat about

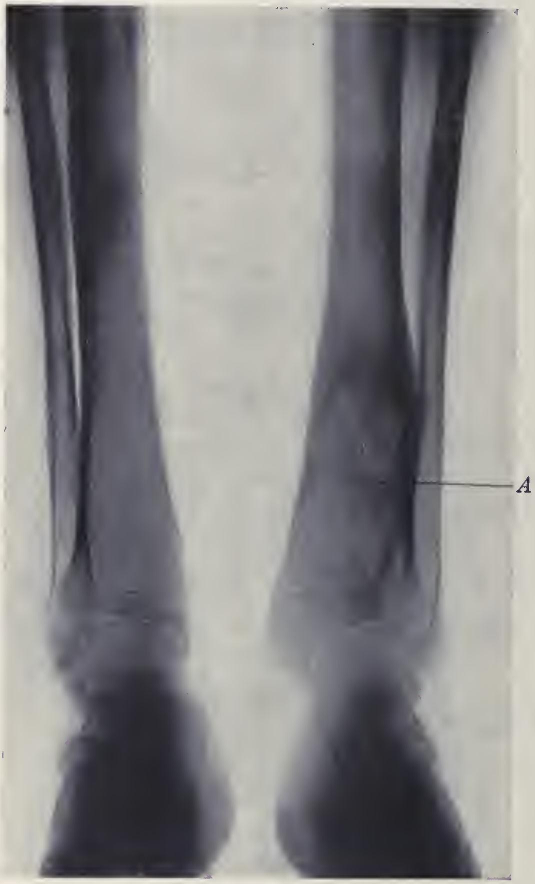

Fig. 770.—Case III. April 24, 1919. Osteitis fibrosa cystica of lower end of tibia: *A*, Definite areas of rarefaction with some bone proliferation at the cortex.

2 x 5 cm. was excised. This was sutured over the bone cavity and the skin edges were then united over this with silkworm-gut and silk.

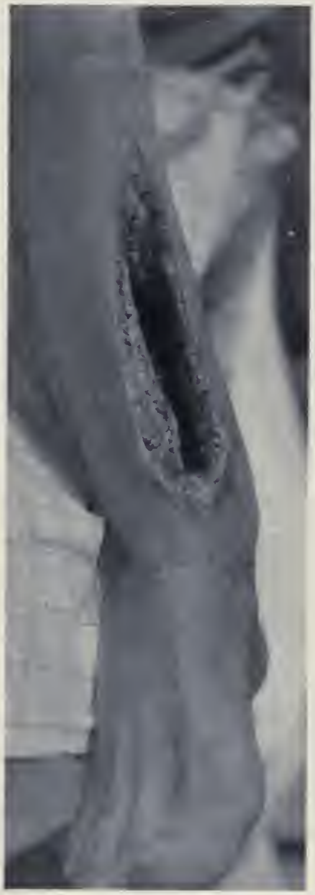

Fig. 771.—Photograph of cavity after treatment with Carrel-Dakin solution and previous to second operation.

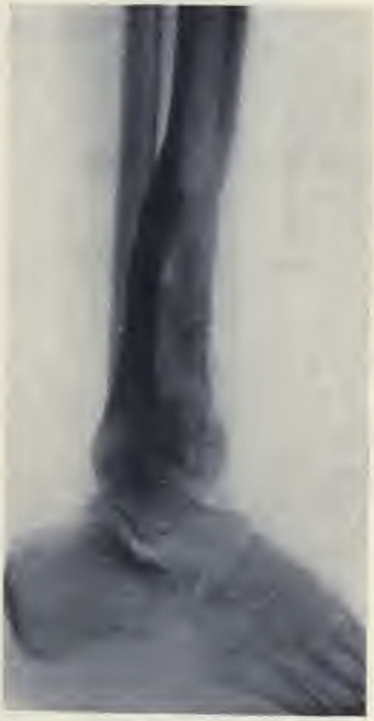

Fig. 772.—Lateral view after insertion of bone-chips in cavity to obliterate dead space. Bone fragments distinctly seen.

There was some separation of the skin following the operation and a portion of the fascia lata also sloughed, but the bone cavity was not infected, and by Carreling the surface the wound granulated over, and on discharge patient had a very small sinus.

He was readmitted in May, 1920 because he had a small sinus, but the sinus was cureted and found to lead down to a small cortical cavity in the bone, which was lined with granulation tissue. Bone about it appeared normal and no fragments could be seen.

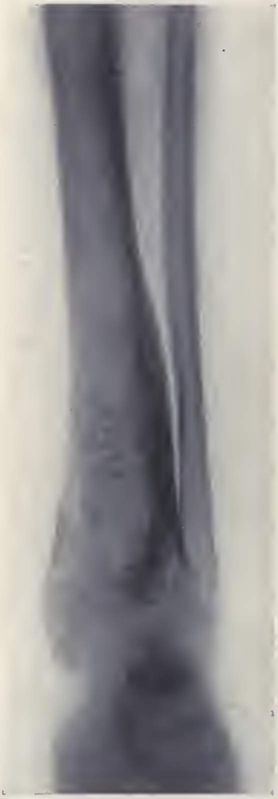

Fig. 773.—Anterior-posterior view of Fig. 772. Bone fragments distinctly seen.

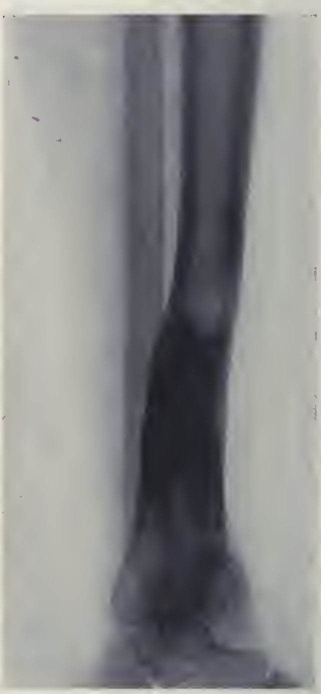

Fig. 774.—April, 1921. Marked new production of bone obliterating cavity. Disappearance of bone-chips.

Cavity was swabbed with carbolic acid and the wound closed without drainage. Obtained a primary union, and since this time he has been well. As can be seen by the *x*-ray, the bone-chips have caused a production of new bone about them and a dead space has been completely obliterated.

Comment.—At the time of operation his case was diagnosed as a bone abscess by the pathologist's report, and later history would suggest that it was a case of osteitis fibrosa cystica.

The onset of this disease is rare after twenty years of age. It is chronic and tends to lead to a bone-cyst. In the intermediary stages there frequently are cellular elements which are either spindle-cells of the connective tissue type, or round cells, which are considered by some to be endothelium, and by others as plasma-cells. The tissue has frequently been wrongly diagnosed as sarcoma. The disease has a tendency to extend gradually, and in the last *x*-ray taken of this case there is a slightly rarefied area above the old tumor which suggests a possible extension. When last heard from, two weeks ago, this patient was feeling well. There was no sinus, but, unfortunately, he has gone to Europe and further trace of him will be difficult. The pathologist's report in this case suggests strongly the diagnosis.

Case IV.—A man aged thirty. Chief complaint limitation of motion in right knee-joint, pain in the right knee on flexion or extension of knee.

Present Illness.—Fifteen years ago the patient was kicked by a horse while he was in Greece. He was taken to a hospital, where he remained for one year. It is evident from his history that at that time he had a compound fracture of the upper third of the tibia. For the last fourteen years he has always had some limitation of motion and pain on walking.

Physical examination negative, except for the surgical condition. The right leg below the knee shows a bowing with angulation at the upper third of the tibia and fibula. There is a wide scar on the anterior surface over the tibia entirely healed. No sinus. Over the upper third of the leg there is an area of tenderness about 3 inches in diameter between the tibia and fibula. There is limited flexion in the knee-joint, but no pain on motion. This area fluctuates and is tender on pressure.

Patient admitted on July 2, 1920.

July 3d: Vertical incision about 4 inches long was made over the fluctuating area. About an ounce of thick, greenish pus was evacuated. Two Carrel tubes were inserted. Culture at this time showed a pure growth of Staphylococcus aureus.

The case was treated by Carrel for one week. A week later the previous incision was enlarged and a small cloaca was found on the under surface of the tibia extending into the bone and upward toward the head. It was thought inadvisable to enter this cavity through the tibia tubercle. Therefore a transverse incision was made, exposing the mesial surface of the tibia. With a gouge and hammer the cavity was opened into and a dirty granulation tissue removed by the curet. Fat removed from the buttocks was transplanted into the cavity and the skin was sutured over.

Postoperative History.—The portion of the skin-flap which had been the seat of the previous scar and was adherent to the bone sloughed, but at no time was there any discharge of fat. When the patient left the hospital on his twenty-fourth day postoperative the wound was clean and granulating.

February 2, 1921: Wound has been closed for two months. Returned to work three days after leaving the hospital. No pain or swelling. Examination: No sinus. Wound clean. No bony tenderness. General condition good.

I have presented these 4 cases because they present different problems in the treatment of infected dead spaces in bone.

In Cases I and II the surrounding tissues could be so drawn over the cavity that obliteration could be hoped for by shelving the edges of the cavity and allowing the surrounding space to fall in after sterilization by the Carrel-Dakin technic.

In Case III (Fig. 771) there was a large dead space in the lower end of the tibia with a surrounding skin which had been infected for a long period, and was thickened and brawny, and it would have been difficult to transplant any skin-flap to cover this area. In this case we used bone-chips with the idea that they would stimulate osteogenesis. It might have been more advisable to use a fat transplant, but we were fortunate enough to succeed where in another similar procedure failure might have resulted.

In Case IV, an old chronic cavity with a relatively non-virulent organism, a fat transplant was inserted without previous sterilization because it was felt that, with the surrounding skin so traumatized, if the wound were left open there would be marked contraction and it would be very difficult to cover this cavity. The skin sloughed to a certain degree, but the fat transplant remained in place and the patient is now well and

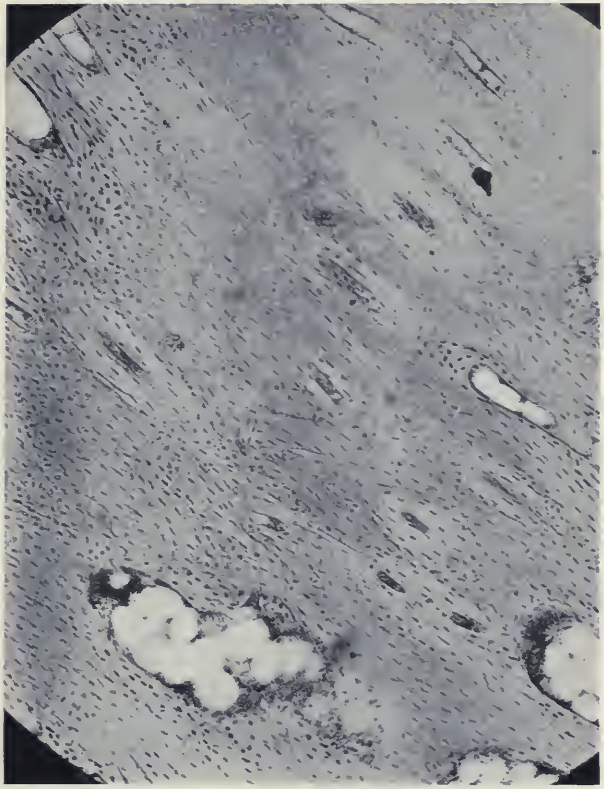

Fig. 775.—Bone fragments transplanted to bridge defect in radius of dog. High-power view of bone fragment six weeks after transplantation. Active bone-cells as seen about the haversian canals. Where the circulation has not been established nuclei are absent.

about without any sinus, and appears in very good condition. Dr. Walton Martin, of New York, has described this method of fat transplants in a paper read before the New York Surgical Society on October 8, 1919, and published in the Annals of Surgery January, 1920.

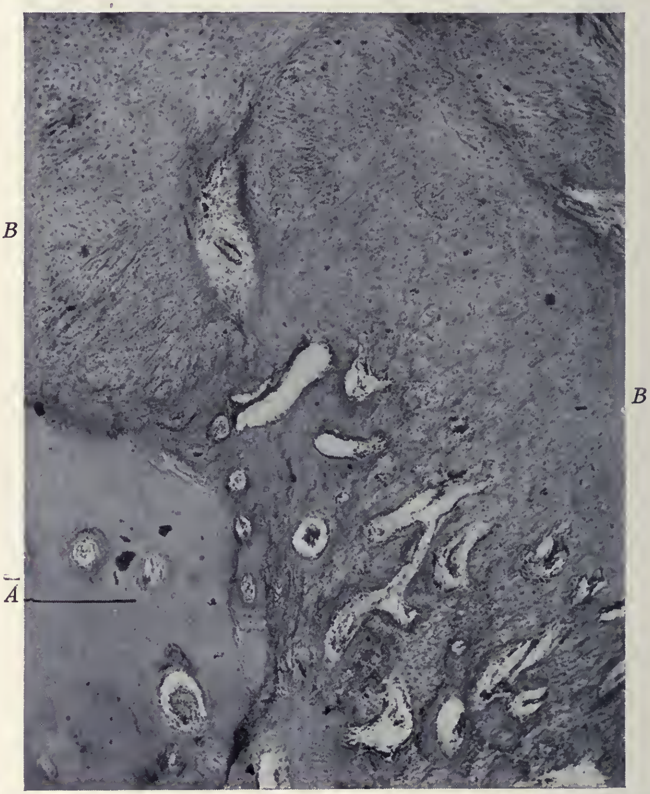

Fig. 776.—Low-power view of transplant surrounded by new bone and cartilage arising from granulation tissue: *A*, Transplant; *B*, new bone in fibrocartilage.

Relative to the small bone transplants used in Case III, it is interesting to note how the clinician and the laboratory worker have differed in their accounts of the after-history of a graft.

The clinician has usually stated that bone-grafts live, because if occasion should arise that it is necessary to perform a secondary operation, he finds that the cut section of the graft bleeds and that it has the general appearance of living bone. Radiographs taken also show the graft appearing as normal bone.

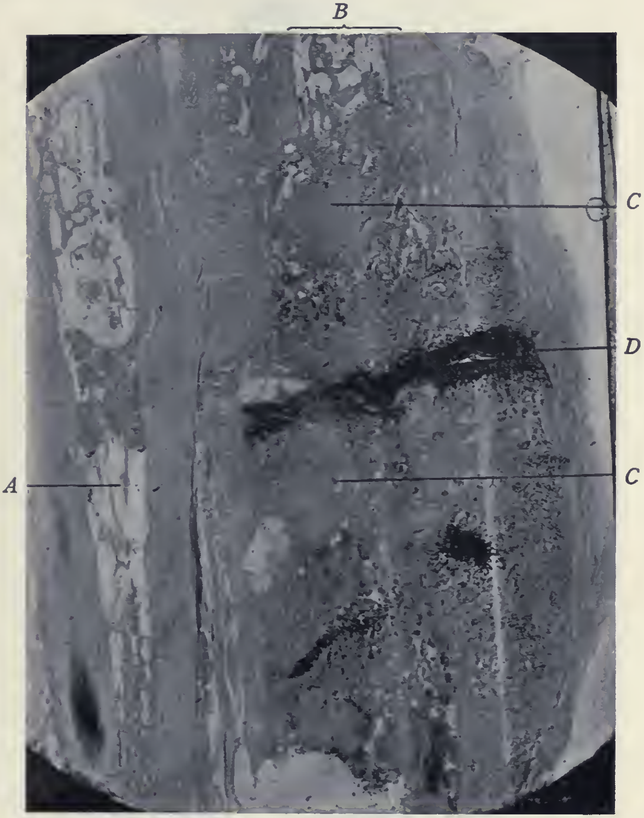

Fig. 777.—Low-power view of transplants bridging defect in radius: *A*, Ulna; *B*, radius; *C*, transplants surrounded by new bone proliferation; *D*, zone of cartilage with a tendency toward false joint formation.

The laboratory worker on microscopic examination finds in grafts of one to two weeks' duration that the nuclei do not stain and the bone appears dead. Microscopic examination at a later period shows blood-vessels re-established in the Haversian canals and about them one to two layers of living bone-cells.

While portions of the graft apart from the canals show the absence of nuclei (Fig. 775), the process then continues as a gradual absorption of the dead bone and the formation of new bone in its place.

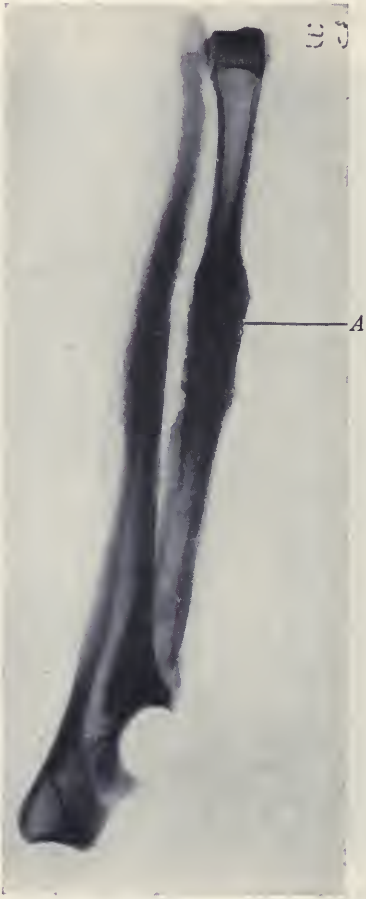

Fig. 778.—*x*-Ray one year after insertion of transplants: *A*, Area where transplants were inserted. Complete union has occurred and it is impossible to detect outline of former transplants.

It is easy to see that the bone at this period would bleed on section and would clinically appear living.

In a series of experiments lasting over two or three years I transplanted small bone fragments 1 to 2 mm. in size into a defect of 3 to 5 cm. of the radius of dogs. Microscopic studies taken at various lengths of time after the operations show in the early stages absence of the nuclei in all of these grafts. There is, however, marked new production of bone about them in the granulation tissue produced immediately after operation. Firm union was the ultimate result in nearly all of these cases, and

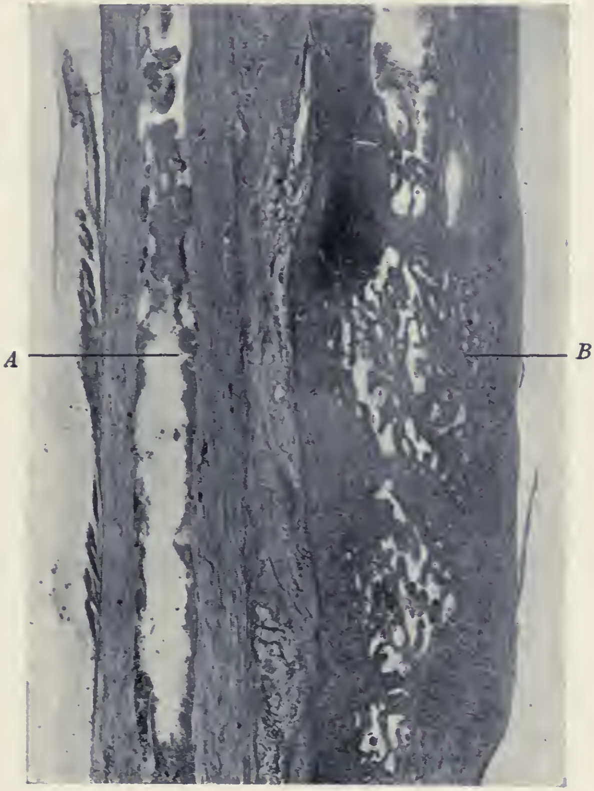

Fig. 779.—Low-power view one year after insertion of transplants in defect of radius: *A*, Ulna; *B*, radius. Transplants no longer visible. Tendency toward the re-establishment of the medullary canal with complete union.

at the end of a year it was impossible to detect the former bone fragments, and the medullary canal was becoming re-established (Figs. 776–779).

I wish to express my thanks to Dr. Eugene H. Pool, Chief of the Second Surgical Division, for the privilege of presenting these cases.

CLINIC OF DR. WALTON MARTIN

St. Luke's Hospital

OSTEOSARCOMA OF THE CLAVICLE AND RETROPERITONEAL SARCOMA

I am presenting 2 patients on whom I have recently operated for sarcoma, with the purpose of discussing prognosis and treatment.

The first patient is a man fifty-three years old, who came to the Out-patient Department about six months ago to be treated for a swelling of the sternal portion of the clavicle accompanied by pain in the arm and neck (Fig. 780).

About a year and a half ago he was struck by a crate in the clavicular region. Two or three weeks later he noticed a small, painful swelling at the site of injury. He consulted a doctor, and was given a salve to apply. The lump continued to grow and the pain increased. His general health was good; he was able to work.

Examination at that time showed a swelling about the size of a walnut over the sternoclavicular joint and extending laterally along the clavicle for 4 or 5 cm. The skin over the enlargement was freely movable and but slightly reddened. On palpation the mass felt tense over the upper portion, in places almost fluctuating; over the lower portion it was firm and as if made up of a thin shell of bone. There was no local heat, no tenderness on pressure, or abnormal mobility in the clavicle. When the man raised his left arm pain was felt along the side of the neck and over the clavicle.

The patient was a small, lean man, with good color of skin and mucous membrane. The temperature was normal and there were no other lesions of joints or bone or lymph-glands. Examination of the lungs and heart was negative. The Wassermann test was negative. x-Ray examination (Fig. 781) shows an area over the inner half of the clavicle, about 4 to 5 cm. in diameter, where the normal shadow cast by the bone is lost. This area of lessened density is sharply marked off by a dark line at the lower and medial portion.

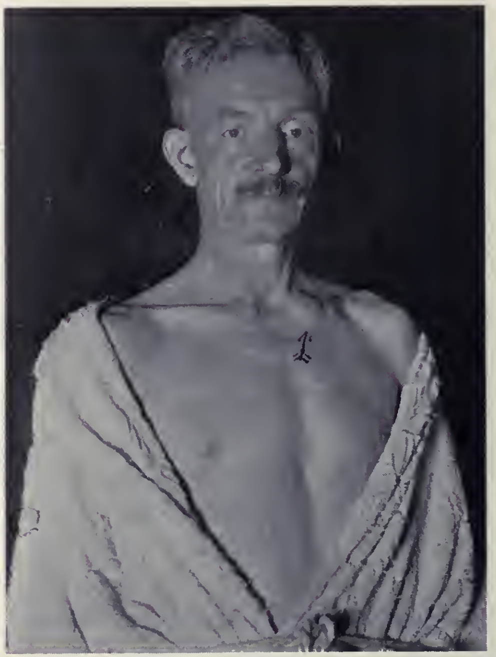

Fig. 780.—Sarcoma of medial end of left clavicle.

In making the diagnosis we considered tuberculosis of the sternal end of the clavicle or the sternoclavicular joint, syphilis, bone-cysts, and neoplasms.

Tuberculosis of the sternoclavicular joint or of the sternal end of the clavicle occasionally occurs, but it is very rare for this joint alone to be involved. There are usually other easily recognizable lesions. At the end of two or three months the skin would probably be involved, with perforation and the formation of the characteristic tuberculous fistulæ. The x-ray plate shows neither new formed bone nor dead bone.

Localized syphilis of the clavicle, hereditary as well as acquired, is not uncommon. It usually attacks the sternal end. It is the lesion we first thought of on seeing this patient, and not considering a negative Wassermann test sufficient evidence of the absence of luetic infection, we advised a course of antisyphilitic treatment. This treatment was carried out for six weeks without any appreciable effect on the focus of disease in the clavicle. Here again the x-ray plate shows neither sequestrum nor signs of bone hypertrophy.

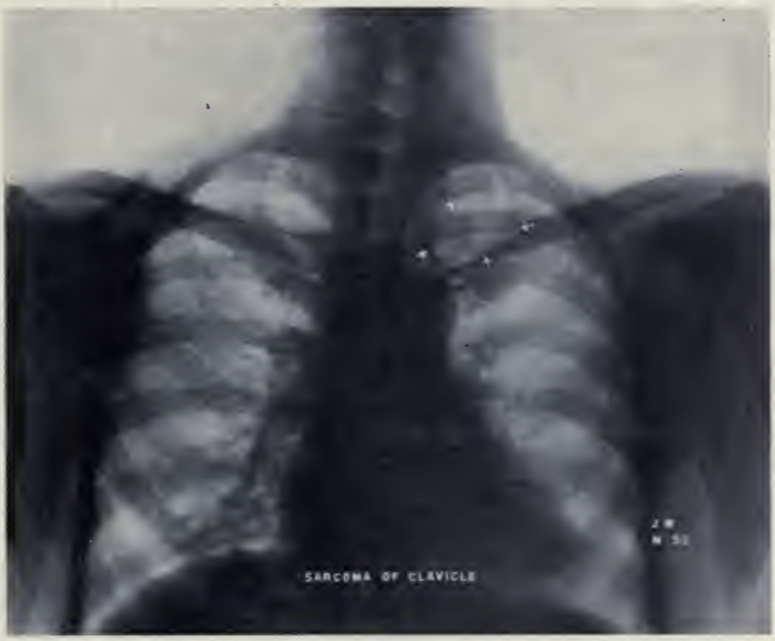

Fig. 781.—x-Ray plate of sarcoma of clavicle. Arrows indicate site of lesion.

Cysts of the clavicle have been described. Some of them, as in other bones, are parasitic, like the echinococcus cyst, some are possibly infectious, others are cystic neoplasms. The x-ray plate should show, however, a distinct, entire, bony capsule.

In Fig. 782 we can easily see that the bone is destroyed in one part.

We were therefore led to the conclusion that the swelling in the clavicle was a new growth.

Of the new growths of the clavicle, sarcomata are by far the most common. Johansson, in 98 reported cases, found that 92 were sarcomata. In this instance the swelling had grown slowly. At the end of a year it was only 1 inch wide and about 1½ inches long. There was apparently no infiltration of the neighboring cellular tissue. We therefore made the diagnosis of a rather slow-growing sarcoma.

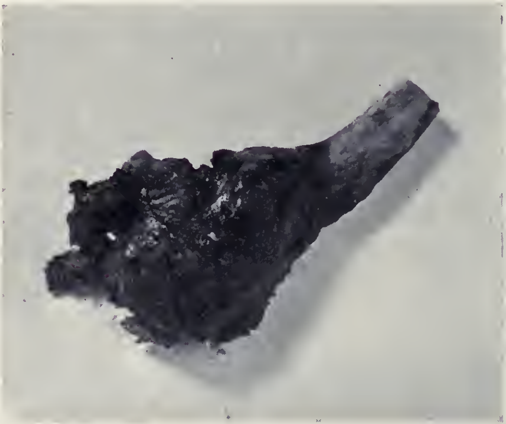

Fig. 782.—Medial half of clavicle with tumor.

A skin incision was made along the clavicle from the sternoclavicular joint to the juncture of the outer and middle third of the bone, the middle of the bone exposed, and a blunt elevator passed beneath it, keeping outside the periosteum. The bone was then cut through with a Gigli saw, the clavicular insertion of the sternocleidomastoid above the tumor was divided, the pectoralis major was severed close to its attachment, the medial portion of the divided clavicle was lifted up by a retractor and the clavicular fibers of the sternohyoid muscle and the costoclavicular ligament were cut, and the sternum was chiseled through close to the sternoclavicular articulation. The upper portion of the tumor mass was freed by dissection and the sternoclavicular joint, the clavicle, and the tumor removed in one piece (Fig. 782). Too much muscle had been removed to enable muscle suture of the severed edges and considerable space was left where the tumor had lodged. Bleeding points were ligated and a small rubber-dam drain inserted. The skin was closed with horsehair.

The drain was removed on the third day and the stitches on the eighth. He had little pain and very slight reaction following the operation. He left the hospital with the wound soundly healed.

The macroscopic examination of the specimen removed showed the sternal half of the left clavicle and included the tumor, which involved the medial third of this bone, and had caused considerable erosion and destruction of the sternoclavicular joint. The neoplasm measured about 3.5 x 4.5 x 2 cm. and was moderately well encapsulated. The globular portion, which completely replaced the bone, was very soft, breaking down readily and leaving a cavity lined with yellowish, cellular tumor tissue adherent to the thick capsule. The lateral portion of the growth had caused a widening of the shaft and marrow cavity, the latter being solidly filled with the tumor. In these areas it was not vascular, but fairly firm and compact. I show a photomicrograph from a section through the tumor tissue (see Fig. 789).

After leaving the hospital he has been given *x*-ray treatment. He has very little disability, the partial or complete removal of the clavicle causing astonishingly little disturbance of function of the arm.

The second patient is an Italian woman thirty-one years old. She is rather poorly nourished, but does not look seriously ill. On examining the abdomen, three long linear scars are seen: one through the right rectus, one through the left rectus, and one in the middle line. The abdominal wall is lax; the skin is wrinkled. On palpation there is a feeling as if there were a large, soft mass in the left side of the lower abdomen and a second one in the epigastric region.

She has been operated on four times: the first time at the Italian Hospital for an abdominal tumor. I have no record of this operation. In September, 1917 she was operated on a second time by Dr. Downes, and a large, soft, oval tumor was found in the retroperitoneal tissue below the lower pole of the kidney. She returned in January, 1919 looking still fairly well, but complaining again of tumors in the abdomen. A mass could be readily palpated in the lower left abdomen. I operated on her at this time and removed two soft tumors—one from the retroperitoneal tissue at the root of the sigmoid mesentery and one from between its folds. The larger mass was thinly encapsulated, lobulated, soft, and measured about 13 x 10 cm. It gave the appearance of a very soft lipoma, but was more yellowish gray and much less firm than the usual lipoma. Thin sections through the tumor were almost translucent and gelatinous.

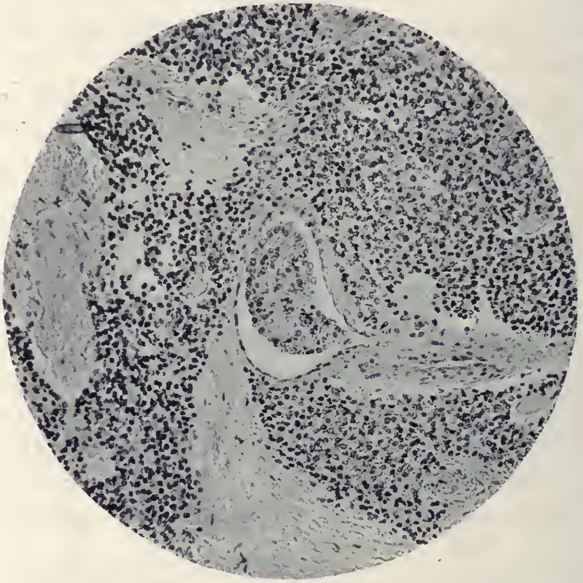

Fig. 783.—Photomicrograph of round-cell sarcoma of the scapula. The photograph shows one of a number of areas in which there was vascular invasion.

After each operation she made a rapid recovery. After leaving the hospital *x*-ray treatment was begun at fourteen-day intervals. She was sent back to me from the *x*-ray department in August of this year because two tumor masses had been felt and seemed to be increasing rapidly under the *x*-ray treatment.

I operated a second time, making her fourth operation, and removed a large mass from beneath the cecum; a second one from near the root of the mesentery of the small intestine, and a third and fourth mass from between the mesenteric folds close to the bowel in the lower portion of the ileum. I could feel another mass beneath the descending colon, but feared to disturb so much of the retroperitoneal tissue. She made a good recovery from this operation, but for three or four days was much distended and showed signs of paralytic ileus.

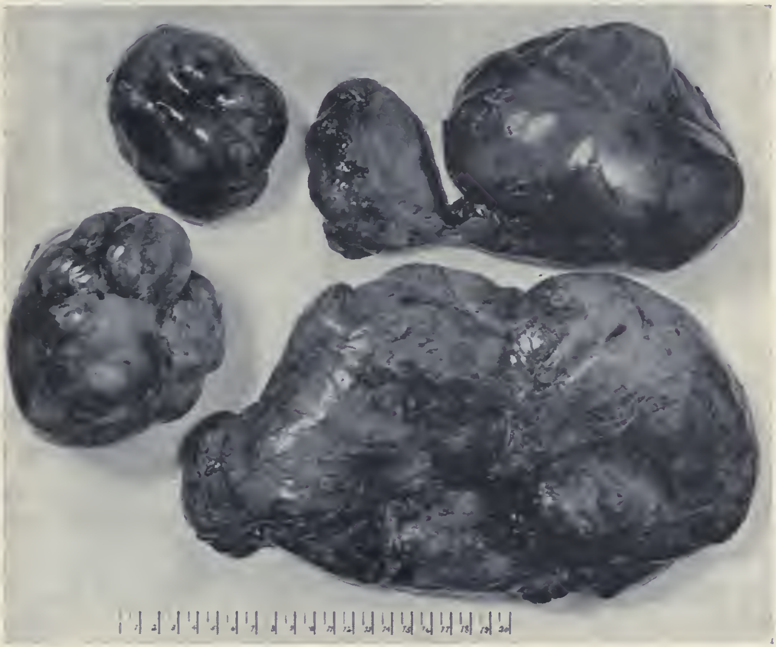

Fig. 784.—Myxoliposarcoma.

The mass beneath the cecum was large, measuring 27 x 15 x 8 cm. The others measured about 12 x 8 cm. They were all very soft, looking juicy and succulent on section, and of a paler yellow than a lipoma. They were slightly lobulated (Fig. 784). In each instance the peritoneum was divided over the mass and then the mass peeled out by very gentle, blunt dissection. I was fearful of tearing vessels, but succeeded in removing the four masses without much difficulty and with surprisingly little oozing.

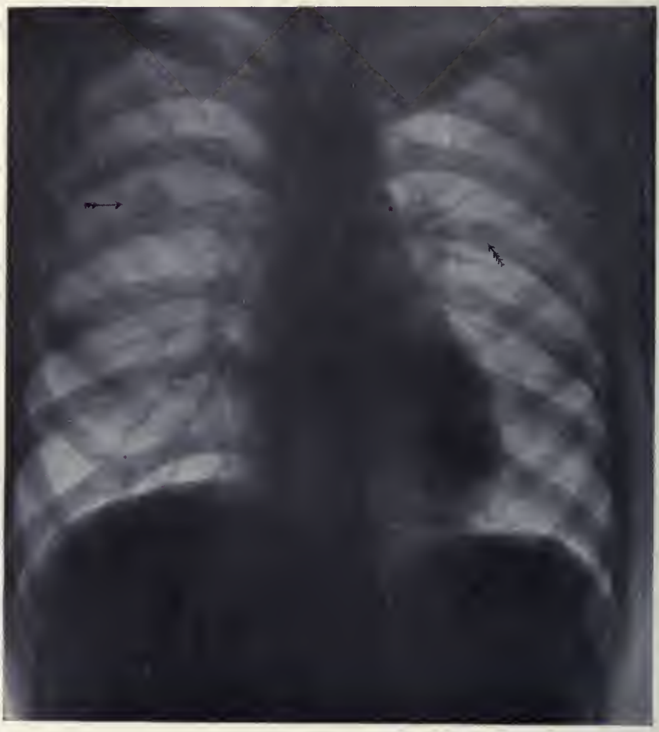

Fig. 785.—Metastatic sarcomata in lung. Arrows indicate lesion.

These retroperitoneal myxoliposarcomata are uncommon. Adami, many years ago, collected 42 examples from the literature. One was reported in 1920 by Hirsch and Wells. The tumor removed at the first operation has often not been considered malignant. The growth is not controlled by the *x*-ray, even in large doses. A wide excision after they have become established is impossible on account of their anatomic situation. Probably in the blunt enucleation of the tumors masses of neoplastic cells are left behind. When they are multiple, as in this case, one may only be removing protrusions from the main tumor mass. The presence of the large abdominal mass, the absence of nearly all symptoms, and the fairly good general health until the tumor becomes very large are characteristic features. During the period of four years in which this patient has been under observation she has borne 2 healthy children.

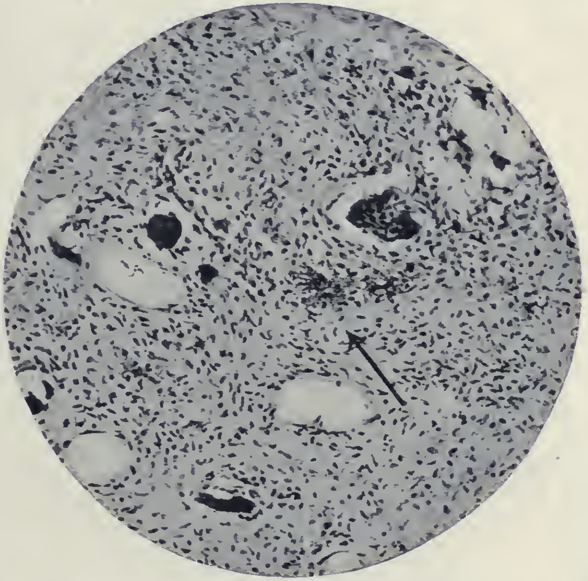

Fig. 786.—Photomicrograph of section of central sarcoma; another area showing a very suspicious interstitial tissue of the osteoid type with beginning calcification.

I show a photomicrograph of this tumor (see Fig. 790).

I should like now to refer to 2 more cases of sarcoma that have come recently under my observation. One, J. N., had a mass in the upper end of the tibia. It was scooped out thoroughly in June, 1919, and then treated vigorously with radium. Finally, an amputation was done through the thigh. In January, 1921 *x*-rays taken of his lungs showed metastases (Fig.

785). He died last summer. Sections of the growth removed at the first operation showed giant-cells, but they were less numerous than in the usual benign myeloid giant-cell tumor and the whole growth was more vascular (Figs. 786, 787).

The second, a boy, W. S., had a tumor of the shoulder. *x*-Ray examination showed a lesion of the scapula (Fig. 788). Microscopic examination of sections, taken from a piece of the tumor removed for diagnosis, gave the appearance of round-cell sarcoma. I show the photomicrograph and give the report of Prof. F. C. Wood (Fig. 783). He was advised to have radium or *x*-ray applied, and was taken by his family to Dr. Bloodgood. The tumor has disappeared under this treatment.

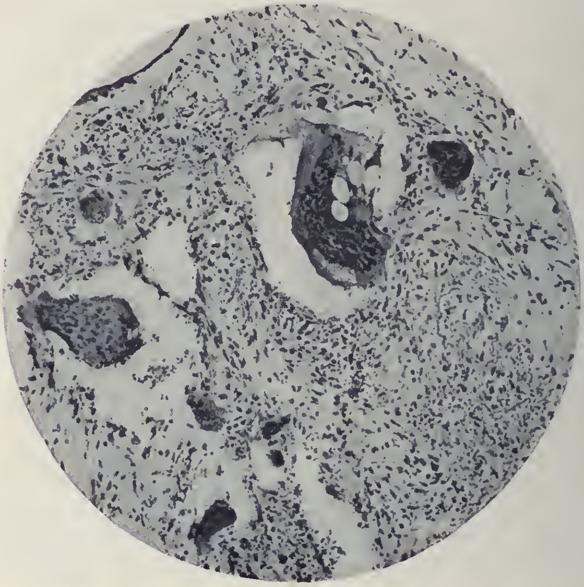

Fig. 787.—Central sarcoma. In this area the tumor is not to be distinguished from the relatively benign type. × 120.

The relation of these cases, each managed in such different fashion, brings up for discussion the question of treatment and prognosis. We all recognize that under the heading of sarcoma is included a group of tumors of widely different significance. The myeloid or giant-cell tumor, like the basal-cell epithelioma in the carcinoma group, for example, is generally recognized as relatively benign, and a far less radical treatment is necessary. The histologic type of the tumor should then always be known.

Unfortunately, this simple statement needs to be qualified. The distinction between different types is not sharply defined. There are many transitional forms. Different parts of the same tumor may show widely different structure. The experience and judgment of the individual pathologist is as important a factor as the experience and judgment of the clinician.

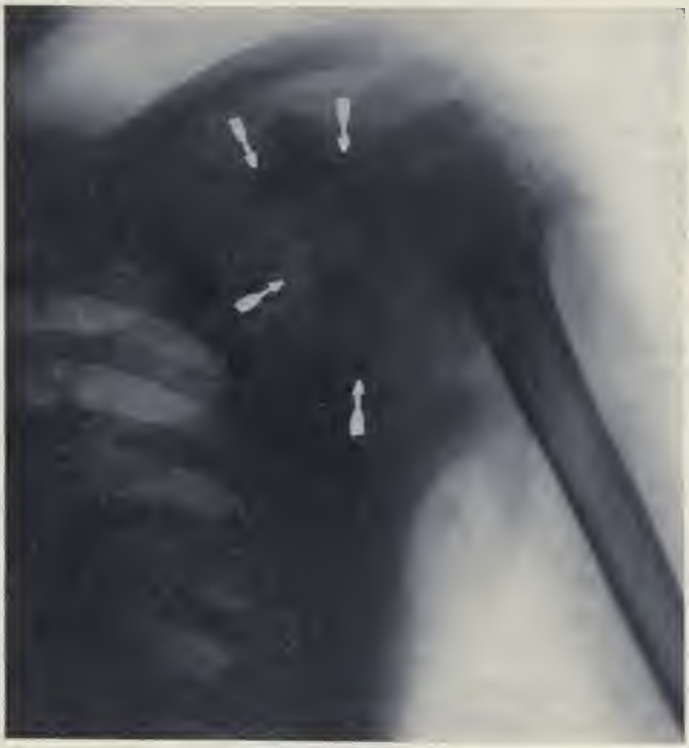

Fig. 788.—*x*-Ray plate of round-cell sarcoma of scapula. Arrows indicate lesion.

In the first case reported we did not cut into the tumor to obtain a piece for examination. We felt fairly sure of the diagnosis of sarcoma. And even if the tumor had been a giant-cell sarcoma, I should still have preferred to excise the growth rather than to scoop it out. The shell of bone was incomplete. After thorough cureting the continuity of the bone would have been broken and the resulting disability the same as if the clavicle had been excised; nor do I believe the removal would have been as complete.

In the fourth case we cut into the tumor and removed a piece for microscopic examination. The growth was in the scapula and was as large as an orange. Wide removal would have necessitated the removal of the scapula and the muscles attached, with the resulting disability. Had the section shown a myeloid tumor it would have been better to do a far less radical operation. Of course there is the risk of transplanting tumor-cells by this procedure. I do not believe the danger is great, however. Transplanted cells have probably a lower vitality than the original cells. Furthermore, the mechanical factors after excision are unfavorable for the lodgment and growth of detached tumor-cells; they are washed away by the blood and lymph flowing from the wound.

The microscopic sections in this case were sent to two pathologists. I have shown the section and given the report of one. The tumor was considered highly malignant; the tumor-cells seemed already in the blood-stream. Local removal, even amputation of the entire upper extremity, would, we thought, afford only temporary relief. Furthermore, it was said by Prof. Ewing, the second pathologist who examined the tissue, to be of a type yielding readily to radium treatment. The tumor is, I am informed, no longer palpable. Whether its disappearance is permanent or not remains to be seen.

In the first case we excised the tumor and then applied Roentgen rays, and this brings up the question of the treatment by *x*-rays after excision. It is done on theoretic grounds. We have as yet no comparison of a large group of cases treated by excision, then treated by *x*-rays, and a group treated by excision alone. It must be years before any such comparison can be made. But in every removal it is possible that groups of tumor-cells may be detached and transplanted into the sound tissue. It is certainly true that we occasionally see recurrences in the scars of the needle punctures made in closing the wound after excision of a malignant tumor. It is reasonable to suppose that the x-ray treatment may prevent some of these grafted tumors. Of course in the excision of a neoplasm, even in anatomic regions where we can dissect through sound tissue well beyond the visible growth, we have no means of detecting the invisible strands and filaments of tumor-cells extending out into the tissue spaces and along the lymphatic vessels. It would be very satisfactory if we had at our disposal an agent that would destroy any neoplastic cells left behind by cutting across some of these unrecognizable, outlying portions of the tumor; an agent that would not damage or destroy the normal tissue cells.

But radium in massive doses did not check the growth of tumor-cells in the third case reported, and the microscopic appearance of this tumor, as you can see (Figs. 786, 787), was such that it might readily have been grouped with the less malignant giant-cell tumors. Nor have Roentgen rays, even in long-continued and large doses, affected the growth in the second patient I show.

Where excision is possible through sound tissue I should prefer excision, and when we have made as thorough removal as possible, then I should think it might be wise to use x-ray treatment for the reasons I have stated.

In tumors, where the histologic type is generally recognized as benign, I should still prefer mechanical removal unless this removal were disfiguring. In patients in whom the situation of the tumor would necessitate a perilous and very mutilating operation and in whom, at the same time, the histologic type of the tumor would suggest a very bad prognosis, I should prefer to have the patient treated by radium or x-ray.

These questions in the end must be decided by the judgment of the individual surgeon, and must change as our knowledge grows of the action of different agents on tumor tissue, and a sound conclusion will only be reached when we know the histologic type of tumor and have had an opportunity to watch the patient for a number of years. It is not satisfactory to speak of curing sarcoma by operation, by radium, or by *x*-ray. One must know the type of the sarcoma and the duration of the cure. On the other hand, the recession of a tumor and the return to health for a few months is well worth while.

The rapid disappearance of certain sarcomata when treated by radium is surprising. Possibly the radium acts by damaging the endothelium of the new formed blood-vessels in the tumor, causing a thrombosis of the vessels, which, in turn, brings about the death of the tumor-cells. Unfortunately, after a period of regression, the sarcoma is found to be growing again as if the outer layer of cells in immediate contact with the sound tissue had been unaffected by the rays.

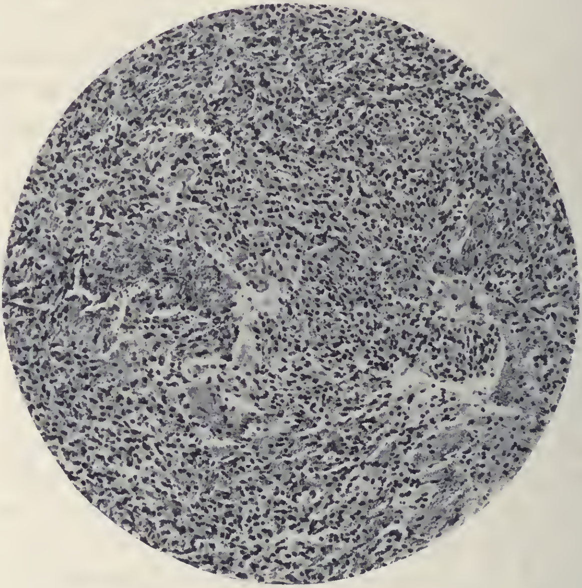

Fig. 789.—Photomicrograph of cellular fibroma or fibrosarcoma of clavicle.

The permanent cures by radium or *x*-ray seem largely to be in the group of new growths in which satisfactory results have been obtained by cureting, by destruction by chemicals, by cauterization, or by the intense cold of liquid air or even the less active carbon-dioxid-snow. It is interesting to see that in each of the tumors shown there might have been a disagreement as to the degree of malignancy, judging by a microscopic study of the sections. In two of them, the first and the last, no true decision can as yet be made.

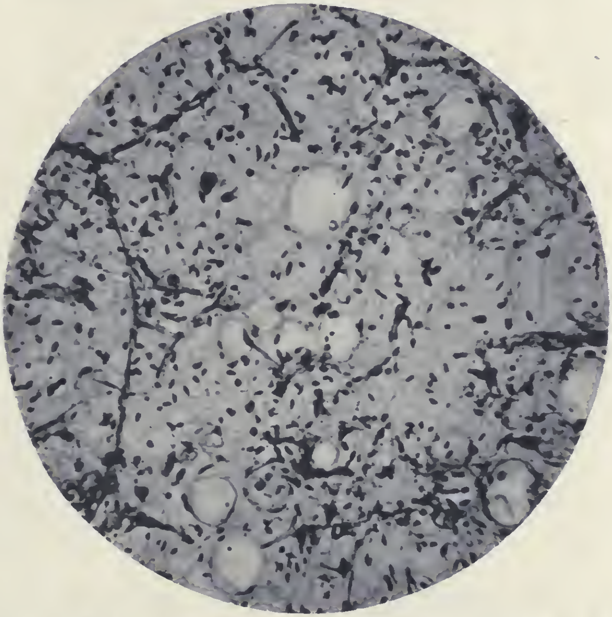

Fig. 790.—Myxoliposarcoma of the retroperitoneal region. The tissue is not very cellular, and except for a knowledge of a clinical cause of these tumors, and the fact that there is great irregularity in the size of the cell nuclei, the tumor would not be diagnosed as a sarcoma. A number of fat cells are well shown.

INDEX TO VOLUME 1

- Abdomen, acute conditions of, *Oct.*, 1473
    - diagnosis, *Oct.*, 1476
    - differential diagnosis, *Oct.*, 1476
    - history in, *Oct.*, 1474
    - pain in, *Oct.*, 1473
    - treatment, *Oct.*, 1478
  - salivary gland of, *Feb.*, 16
  - silent, *Oct.*, 1479, 1481
- Abortion, incomplete, *Feb.*, 163
- Abscess, bone, localized, *Dec.*, 1773
  - Brodie's, *Dec.*, 1773
  - of lung, *June*, 765
    - age in etiology of, *June*, 767
    - anesthesia for operation in, *June*, 778
    - diagnosis, *June*, 768
    - due to removal of tonsils, *June*, 766
    - etiology, *June*, 765
    - history taking in, *June*, 768
    - mortality in, *June*, 777
    - operation in, *June*, 778
    - physical examination in, *June*, 774
    - prognosis in, *June*, 777
    - situation of, *June*, 768
    - sputum examination in, *June*, 769
    - surgical treatment, *Oct.*, 1430
    - *x*-ray examination in, *June*, 771
  - subdiaphragmatic, operative treatment, *Oct.*, 1437
- Accessory pancreas, *Feb.*, 2
- Acini of pancreas, *Feb.*, 7
- Adamantinoma of lower jaw, *Feb.*, 255
- Adenocarcinoma, intradural encapsulated metastatic, attached to cervical cord, *Dec.*, 1679
  - of large intestine, *Aug.*, 1047, 1064
- Adenoma, cystic, of ovary, *April*, 267
- Adenomas, fetal, *Oct.*, 1306
- Adenomyoma presenting as a tumor of bladder, *Oct.*, 1271
- Albarran incision for exposure of kidney, *April*, 446
- Alcohol injections in trigeminal neuralgia, *Feb.*, 108, 117
  - of gasserian ganglion, *Feb.*, 124
- Ampulla of Vater, *Feb.*, 8
- Amputation, aperiosteal, Bunge method, *Aug.*, 1148
  - Chopart, *June*, 714
  - Lisfranc, *June*, 714
  - of breast for carcinoma, *Feb.*, 185
    - Stewart incision, *Feb.*, 185
    - *x*-rays after, *Feb.*, 195
  - of thigh, *Aug.*, 1113
    - Krüger's method of treating nerves in, *Aug.*, 1147
    - Ritter's method of treating nerves in, *Aug.*, 1146
    - technic, *Aug.*, 1140
  - Pirogoff, *June*, 714
  - stump, Bunge method of treating, *Aug.*, 1148
    - Hirsch's method of care, *Aug.*, 1149
    - neuroma of, *June*, 903
    - postoperative routine care, *Aug.*, 1149
  - Syme, *June*, 711, 715. See also *Syme amputation.*
- Amylopsin, *Feb.*, 10
- Anemia, pernicious, splenectomy in, *Oct.*, 1314
  - splenic, splenectomy in, *Oct.*, 1308
    - syphilitic, splenectomy in, *Oct.*, 1310
- Anesthesia, choice of, in thoracic surgery, *Oct.*, 1443
  - ether, facilitated by stomach-tube in pyloroplasty, *June*, 799, 805
  - local, in ligation of inferior thyroid artery and vein, *Aug.*, 981
    - in operating for acute appendicitis, *Aug.*, 945
      - for cancer of pyloric end of stomach, *Aug.*, 945
    - in thyroidectomy, *Aug.*, 981
    - splencetomy under, *Aug.*, 965
  - paravertebral, in thoracotomy, *Oct.*, 1444–1446
- Aneurysm, bone, *Feb.*, 70
- Angioma of knee-joint, *June*, 681
  - operation for, *June*, 684
- Angiotribe, Blunk, *Dec.*, 1653

- Angle of Treitz, *April*, 506
- Ankle-joint, lipoma arborescens of, *Aug.*, 1213
- Antrum cannula, *Oct.*, 1390
- Anuria and reflex suppression of urine, *April*, 425
  - due to blockage, *April*, 430
  - nephrotomy and decapsulation for, *April*, 432
  - reflex, that responds to ureteral catheterization, *April*, 437
    - ureteral calculus with, *April*, 436
  - renal lithiasis and chronic nephritis with, *April*, 433
- Anus, digital dilatation of, *Feb.*, 167, 168
- Aperiosteal amputation, Bunge method, *Aug.*, 1148
- Aphasia, *June*, 913
- Apoplexy, pancreatic, *Feb.*, 18
- Appendectomy, *April*, 523
  - death after, causes of, *April*, 558
  - in acute appendicitis, *April*, 551
    - technic, *April*, 556
  - in chronic appendicitis, *April*, 519
    - after-treatment, *April*, 532
    - incision, *April*, 525
    - operation, *April*, 525
- Appendical fecal fistula, postoperative, *Aug.*, 1227
- Appendicitis, acute, *April*, 551
    - appendectomy in, *April*, 556
    - blood count in, *April*, 555
    - in pregnancy at term, *Aug.*, 1003
    - initial stage of, *April*, 554
    - local anesthesia in operating for, *Aug.*, 945
    - perforation in, *April*, 553, 554
    - postoperative treatment, *April*, 558
    - sequence of symptoms in, *April*, 553
    - symptomatology of, *April*, 555
  - chronic, *April*, 519
    - appendical dyspepsia in, *April*, 523
    - dyspepsia in, *April*, 523
    - operation in, *April*, 525
    - pain in, *April*, 523, 524
    - postoperative treatment, *April*, 532
    - pyloric syndrome in, *April*, 523, 524
    - reflex pylorospasm in, 524
  - ileus complicating, high enterostomy for, *Dec.*, 1663
    - technic, *Dec.*, 1666
- Appendix, diseased, gastro-duodenal ulceration and, differential diagnosis, *April*, 534
- Aran-Duchenne paralysis in brachial plexus injury, *April*, 579
- Arthritis of hip, *June*, 910
- Arthrodesis for tuberculosis of sacro-iliac joint, *June*, 704
  - substragalar, *Feb.*, 156
- Arthroplasties, *June*, 886
- Arthroplasty of knee-joint, incision for, *Oct.*, 1489
- Artificial leg, temporary, method of constructing, *Aug.*, 1151
  - pneumothorax in suppurative bronchiectasis, *Dec.*, 1542
  - vagina, method of constructing, *June*, 611
    - operation, *June*, 612
- Ascending colon, carcinoma of, symptomatology, *June*, 744
- Automatic grafting razor, Hoffmann's, *Dec.*, 1657, 1659
  - skin fixation instrument, *Dec.*, 1658

- BASAL metabolism, *June*, 649
- Base of skull, fracture of, *June*, 594
- Bassini's modified technic in hernia operation, *Dec.*, 1578
- Bauchspeicheldrüse, *Feb.*, 16
- Biliary disease, jaundice in, causation of, *April*, 536
  - ducts, calculous disease of, diagnosis, *April*, 539
  - fistula and cholecystectomy, *Aug.*, 1217
  - tract, surgery of, *April*, 373
- Birth injury of shoulder, *Feb.*, 127
- Bladder, adenomyoma of, *Oct.*, 1271
  - diverticulum of, *Oct.*, 1267
  - exstrophy of, treatment, formation of a cloaca in, *Oct.*, 1257
- Bleeding pyelitis, *Aug.*, 1022
- Blood count in acute appendicitis, *April*, 555
  - examination of, in pneumococcus peritonitis, *April*, 312
  - sweating, *April*, 341
- Blood-supply of pancreas, *Feb.*, 4
- Blunk angiotribe, *Dec.*, 1653
- Bone abscess, localized, *Dec.*, 1773
  - aneurysm, *Feb.*, 70
  - cyst, malignant, *Feb.*, 70
  - dead spaces in, infected, methods of closing, *Dec.*, 1773
  - Paget's disease of, *Feb.*, 47
    - metabolic changes of, *Feb.*, 57
  - sarcoma of, *Feb.*, 67
- Bow-legs in adolescent, *Aug.*, 1077
- Brachial plexus, injuries of, *April*, 561
    - Aran-Duchenne paralysis in, *April*, 579

Brachial plexus, injuries of, ciliospinal reflex in, *April*, 578
    Duchenne-Erb paralysis from, *April*, 580
        operation for, *April*, 586
        treatment, *April*, 582
        splint for, *April*, 575
        regeneration in, *April*, 583
    Klumpke - Déjerine syndrome in, *April*, 578
    obstetric paralysis from, *April*, 575
  neurolysis of, *Feb.*, 127
  stab wound of, *April*, 562
    electric examination in, *April*, 568
    examination in, *April*, 563
    individual muscle action in, *April*, 565
    local examination in, *April*, 564
    motor examination in, *April*, 564
    nerve liberation in, *April*, 571
    operation in, *April*, 570
    paralysis in, *April*, 562
    repair of nerves in, *April*, 563
    splint for, *April*, 572, 573
Brain, carcinoma of, *Oct.*, 1350
  concussion of, *June*, 589
    symptoms, *June*, 591
  endothelioma of, *Oct.*, 1344
    removal, *Oct.*, 1358
  glioma of, *Oct.*, 1349
  gumma of, *Oct.*, 1350
  laceration of, *June*, 596
  neurofibroma of, *Oct.*, 1347
  sarcoma of, *Oct.*, 1350
  stem lesions, operations for, *Oct.*, 1359
  tuberculoma of, *Oct.*, 1350
  tumors of, decompression in, *Oct.*, 1356, 1357
    differential diagnosis, *Oct.*, 1351
    osteoplastic flap in operations for, *Oct.*, 1357
    pathology, *Oct.*, 1343
    radium in, *Oct.*, 1360
    surgical treatment, *Oct.*, 1356
      care after, *Oct.*, 1360
      end-results, *Oct.*, 1361
    symptoms, *Oct.*, 1350
    treatment, *Oct.*, 1343
    ventriculography in, *Oct.*, 1353
  wound of, *June*, 913
Breast, cancer of, *Oct.*, 1503
    amputation for, *Feb.*, 185
      Stewart incision, *Feb.*, 185
      x-rays after, *Feb.*, 195
Breast, cancer of, lymphatics of female breast in relation to, *Aug.*, 1025
  female, lymphatics of, in relation to cancer of breast, *Aug.*, 1025
  tuberculosis of, *June*, 919
Brodie's abscess, *Dec.*, 1773
Bronchiectasis, suppurative, adhesions in, *Dec.*, 1542
    artificial pneumothorax in, *Dec.*, 1542
    bronchoscopy in, *Dec.*, 1542
    single-stage lobectomy in, *Dec.*, 1541
      incision in, *Dec.*, 1544
      position of patient for, *Dec.*, 1543
      postoperative complications, *Dec.*, 1549
      sprue as probable cause of death in, *Dec.*, 1550
      technic, *Dec.*, 1544
  surgical treatment, *Oct.*, 1436
Bronchoscopy in suppurative bronchiectasis, *Dec.*, 1542
Buerger's disease, *Feb.*, 73
Bunge method of aperiosteal amputation, *Aug.*, 1148
Burns, *x*-ray, *Aug.*, 935

CALCULOUS disease of common duct, diagnosis, *April*, 539
Calculus in ureter with reflex anuria, *April*, 436
    with symptoms simulating intestinal obstruction, *April*, 424
  renal, *June*, 833. See also *Renal calculus.*
Camptocormia, *Dec.*, 1583
Cancer. See *Carcinoma.*
Cancer-cell implantation, danger of, rules for avoiding, *Dec.*, 1645
Cannula, antrum, *Oct.*, 1390
Canthus of eye, outer, epithelioma of, case report, *Dec.*, 1643. See also *Epithelioma.*
Carcinoma, early recognition of, importance of, *June*, 791
  of ascending colon, symptomatology, *June*, 744
  of brain, *Oct.*, 1350
  of breast, *Oct.*, 1503. See also *Breast, cancer of.*
    amputation for, *Feb.*, 185
      Stewart incision, *Feb.*, 185
      x-rays after, *Feb.*, 195
    lymphatics of female breast in relation to, *Aug.*, 1025
  of cardia through abdominothoracic incision, *Oct.*, 1437

- Carcinoma of cecum, symptomatology, *June*, 741
  - of cervix uteri, inoperable, radium in treatment of, *June*, 615
    - radium in treatment of, *June*, 615
    - surgical treatment, *June*, 785
  - of descending colon, symptomatology, *June*, 748
  - of esophagus, operation on, through thoracic approach, *Oct.*, 1437
  - of floor of mouth, *June*, 907
  - of large intestine, symptomatology, *June*, 739
  - of lower end of esophagus, *Dec.*, 1725
    - clinical examination in, *Dec.*, 1732
    - diagnosis, *Dec.*, 1731
    - emaciation in, *Dec.*, 1732
    - history of 3 cases, *Dec.*, 1725
    - passing of esophageal bougies in, *Dec.*, 1733
    - radium in, *Dec.*, 1736
    - surgeon's function in, *Dec.*, 1734
    - surgical treatment in, *Dec.*, 1736
    - swallowing in, *Dec.*, 1731
    - *x*-ray examination in, *Dec.*, 1734
  - of prostate discovered at operation, prognosis in, *Oct.*, 1279
    - types, *Oct.*, 1283
  - of pyloric end of stomach, local anesthesia in operating for, *Aug.*, 945
  - of rectosigmoid juncture, *June*, 745
  - of rectum, *April*, 353
  - of sigmoid flexure, symptomatology, *June*, 751
  - of stomach, inoperable, jejunostomy as palliative measure in, case report, *Dec.*, 1619, 1627
  - of transverse colon, symptomatology, *June*, 746
  - surgery about eyelids, indications in, *Dec.*, 1645
- Cardia, carcinoma of, through combined abdominothoracic incision, *Oct.*, 1437
- Cartilaginous exostoses, multiple, *Feb.*, 249
- Cauda equina and conus, endothelioma of, *Dec.*, 1687
  - laminectomy in, *Dec.*, 1688
- Caustic paste in treatment of epithelioma, *Dec.*, 1643
- Cautery, actual, in benign lesions of stomach and duodenum, *Oct.*, 1233
- Cautery, actual, in gastric ulcers, *Oct.*, 1234
- Cecum, carcinoma of, symptomatology, *June*, 741
  - non-tuberculous inflammation of, *April*, 361
- Cellulitis of forearm and thigh, *Feb.*, 173
- Cerebellar tumors, operations for, *Oct.*, 1359
- Cervical cord, intradural encapsulated metastatic adenocarcinoma attached to, *Dec.*, 1679
  - tumor of, with sensory manifestations, *Dec.*, 1699.
    - laminectomy in, *Dec.*, 1700
  - rib, operation for removal, *April*, 325
    - Pool's operation for, *April*, 325
    - Taylor's operation for, *April*, 337
  - roots, relation of, to birth palsy, *April*, 578
- Cervix uteri, cancer of, inoperable, radium in treatment of, *June*, 615
  - radium in treatment of, *June*, 615
  - surgical treatment, *June*, 785
- Cesarean section, transperitoneal, *Aug.*, 1157
- Chemical examination of renal calculus, *June*, 847
- Chest. See *Thorax.*
- Chiasmal lesions, ocular phenomena in, not of pituitary origin, *Oct.*, 1363
- Choked disk in tumors of brain, *Oct.*, 1351
- Cholecystectomy, *April*, 533
  - biliary fistula and, *Aug.*, 1217
  - discussion of merits of, *April*, 543
  - Sims' posture after, *April*, 297
  - technic, *April*, 541
  - wound, extraperitoneal drainage of, *Aug.*, 1197
- Cholecystitis, chronic, *April*, 279
  - diagnosis, *April*, 538, 539
- Cholecystostomy, discussion of merits of, *April*, 543
- Cholelithiasis, *April*, 533
  - diagnosis, *April*, 538, 539
- Chondro-osteoma of humerus, *Feb.*, 253
- Chondroplasia, hereditary deforming, *Feb.*, 250
- Chopart amputation, *June*, 714
- Ciliospinal reflex in brachial plexus injury, *April*, 578
- Cirrhosis of pancreas, *Feb.*, 26
- Clavicle, osteosarcoma of, *Dec.*, 1789

Cloaca, formation of, in treatment of exstrophy of bladder, *Oct.*, 1257
Coccyx, partial necrosis of, *Aug.*, 1215
Colic intussusception, *Aug.*, 1087
Colon, ascending, carcinoma of, symptomatology, *June*, 744
  descending, carcinoma of, symptomatology, *June*, 748
  dilatation of, *Aug.*, 1047
  transverse, carcinoma of, symptomatology, *June*, 746
Concussion of brain, *June*, 589
  symptoms, *June*, 591
Congenital dislocation of hip, unexpected end-results following treatment, *June*, 691
  hypertrophic pyloric stenosis, *June*, 797
Conus and cauda equina endothelioma of, *Dec.*, 1687
    laminectomy in, *Dec.*, 1688
Corner's incision, *Oct.*, 1486
Craniocerebral injuries in fracture of skull, *Dec.*, 1709
Craniotomy, suboccipital, and removal of arches of atlas and axis under local anesthesia, *Dec.*, 1693
Crucial ligaments, *Dec.*, 1598
  function of, *Dec.*, 1599
  injuries, *Dec.*, 1605
    causation, *Dec.*, 1606
    semilunar fibrocartilage injury and, differentiation, *Dec.*, 1609
    symptoms, *Dec.*, 1606
    treatment, *Dec.*, 1606
Cyst, hemorrhagic, of upper left femur, *Oct.*, 1493
    right femur, *Oct.*, 1494
  hydatid, of liver, *Feb.*, 37
    Santoni's sign in, *Feb.*, 40
  multilocular, of lower jaw, *Feb.*, 255
  of bone, malignant, *Feb.*, 70
  of mediastinum, dermoid, extirpation of, *Dec.*, 1531
  of thyroglossal tract, *Oct.*, 1509
    diagnosis, *Oct.*, 1509
    treatment, *Oct.*, 1509
Cystic adenoma of ovary, *April*, 267
  ovary, *Feb.*, 159
  tumors of jaw, classification, *Feb.*, 257
Cystocele, plastic operations for, *Feb.*, 90–100
  surgical treatment, *Feb.*, 82
Cystomata, multiple postperitoneal, *June*, 607
    histogenesis of, *June*, 609, 611
    removal of, *June*, 608
      incision for, *June*, 609, 611

DEAD spaces in bone, infected, methods of closing, *Dec.*, 1773
Death after appendectomy, causes of, April, 558
Decompression in tumors of brain, *Oct.*, 1356, 1357
Denuce's method of reduction in dislocation of hip, *June*, 692
Dequervain's method of ligation of inferior thyroid artery and vein, *Aug.*, 981
Dermoid cyst of mediastinum, extirpation of, *Dec.*, 1531
    marsupialization in, *Dec.*, 1534
Descending colon, carcinoma of, symptomatology, *June*, 748
Diaphragm, hernia of, operative treatment, *Oct.*, 1437
Diastase, *Feb.*, 10
Digital dilatation of anus, *Feb.*, 167, 168
Dilatation of colon, *Aug.*, 1047
Dislocation of hip, congenital, unexpected end-results following treatment, *June*, 691
    Denuce's method of reduction, *June*, 692
  of shoulder, old posterior, *Dec.*, 1739
    posterior, production of, *Dec.*, 1740
      types of, *Dec.*, 1740
  recurrent posterior, of hip, *Feb.*, 151
    shoulder, *June*, 882
  sternoclavicular, *June*, 885
Diverticulitis of sigmoid mistaken for cancer, *Aug.*, 1047, 1053
Diverticulum of bladder, *Oct.*, 1267
Drainage, extraperitoneal, of cholecystectomy wound, *Aug.*, 1197
  in pancreatitis, *Feb.*, 34
Dressing in fracture of forearm, *Feb.*, 175
Duchenne-Erb palsy from brachial plexus injury, *April*, 574, 580
Duct of Santorini, *Feb.*, 2, 8
  of Wirsung, *Feb.*, 2, 7
  system of pancreas, *Feb.*, 7
Ductus choledochus, *Feb.*, 2
Duodenal ulcer, *April*, 273, 499
Duodenum, benign lesions, actual cautery in, *Oct.*, 1234
Duval's lung forceps, *Oct.*, 1448
Dyspepsia appendix in chronic appendicitis, *April*, 523

EAR, epithelioma of, *Oct.*, 1401
Echinococcus cyst of liver, *Feb.*, 37

Ectopic testicle, perineal variety, implantation of testicle in scrotum for, *Feb.*, 231
Effusion into both knees in hemophilia, *Feb.*, 179
  in syphilis, *Feb.*, 179
Elephantiasis, *Oct.*, 1523
  etiology of, *Oct.*, 1526
  Kondoleon operation for, *Oct.*, 1527, 1528
  secondary, *April*, 473
Embedded needles, removal of, in broad daylight with intermittent fluoroscopic control, *Aug.*, 1163
Empyema, *April*, 481
  acute, *April*, 349
    surgical treatment, *Oct.*, 1430
  cavity, large, plastic operation for, *Aug.*, 1219
  chronic, surgical treatment, *Oct.*, 1430
  left, chronic, with thoracic fistula, major thoracoplasty and lung mobilization in, *Dec.*, 1551
  of joints, types, *Dec.*, 1604
  treatment of, *April*, 481
Encapsulated intradural metastatic adenocarcinoma attached to cervical cord, *Dec.*, 1679
Encephalitis, lethargic, mistaken for meningeal hemorrhage, *Feb.*, 65
Enchondroma of scapula, *Feb.*, 243
  and long bones, *Feb.*, 249
Endothelioma, hemangiomatous, of spleen, splenectomy for, *Feb.*, 235
  of brain, *Oct.*, 1344
    removal, *Oct.*, 1358
  of conus and cauda equina, *Dec.*, 1687
    laminectomy in, *Dec.*, 1688
  of medulla, giant, *Dec.*, 1693
    diagnosis, *Dec.*, 1694
    indication for and plan of operation, *Dec.*, 1694
    operation, *Dec.*, 1695
    postoperative course, *Dec.*, 1697
Enteric intussusception, *Aug.*, 1087
Enterostomy, high, *Dec.*, 1671
  for ileus complicating appendicitis, *Dec.*, 1663
    technic, *Dec.*, 1666
  rationale of, *Dec.*, 1672
Epileptiform neuralgia, *Feb.*, 106
Epiphysitis, *June*, 634
Epithelioma, adamantine, of lower jaw, *Feb.*, 255
  of ear, *Oct.*, 1401
  of lip, *Feb.*, 197
    fulguration in, *Feb.*, 203
Epithelioma of lip, Grant's operation in, *Feb.*, 204
    radium in, *Feb.*, 204
    treatment, *Feb.*, 203
  of outer canthus of eye, *Dec.*, 1643
    flap plastic repair in, *Dec.*, 1647
    operation, *Dec.*, 1647
  treatment of, *Dec.*, 1643
    caustic paste in, *Dec.*, 1643
    radiotherapy in, *Dec.*, 1643
    surgical excision in, *Dec.*, 1644
Equinovarus deformity, *June*, 888
Erb's point, *April*, 578
Esophagus, cancer of lower end, *Dec.*, 1725
    clinical examination in, *Dec.*, 1732
    diagnosis, *Dec.*, 1731
    emaciation in, *Dec.*, 1732
    history of 3 cases, *Dec.*, 1725
    passing of esophageal bougies in, *Dec.*, 1733
    radium in, *Dec.*, 1734
    surgeon's function in, *Dec.*, 1734
    surgical treatment in, *Dec.*, 1736
    swallowing in, *Dec.*, 1732
    x-ray examination in, *Dec.*, 1734
  operation on, through thoracic approach, *Oct.*, 1437
Ether anesthesia facilitated by stomach-tube in pyloroplasty, *June*, 799, 805
Excision, scar, *June*, 904
Exophthalmic goiter, *April*, 261
Exostoses, multiple cartilaginous, *Feb.*, 249
Exstrophy of bladder, treatment of, formation of a cloaca in, *Oct.*, 1257
Extirpation of dermoid cyst of mediastinum, *Dec.*, 1531
Extramedullary tumor at first dorsal segment, *Dec.*, 1705
    laminectomy for, *Dec.*, 1706
Extraperitoneal drainage of cholecystectomy wound, *Aug.*, 1197
Extremities, left upper, and shoulder girdle, multiple fractures of, *Dec.*, 1587
Eye, epithelioma of outer canthus of, case report, *Dec.*, 1643. See also *Epithelioma.*
Eyelids, cancer surgery of, indications in, *Dec.*, 1645

FAT necrosis in acute pancreatitis, *Feb.*, 13, 14, 19
  subcutaneous, use of, in peritoneal cavity, *Oct.*, 1469
  transplantation of, in peritoneal cavity, *Oct.*, 1465
Fecal fistula, postoperative appendical, *Aug.*, 1227
    tuberculous, *Aug.*, 1047, 1054
Femoral hernia, varix in Scarpa's triangle simulating, *Dec.*, 1673
Femur, acute hematogenous osteomyelitis of, *Dec.*, 1757
  and hip, plastic surgery of, *April*, 391
  fracture of, old, wearing Lane plate, *Aug.*, 1073
  osteochondroma of, *Feb.*, 251
  shaft of, fibrocystic lesion of upper portion of, case report, *Dec.*, 1633
      differentiation, *Dec.*, 1641
      treatment, *Dec.*, 1637, 1641
  upper left, hemorrhagic cyst of, *Oct.*, 1493
    right, hemorrhagic cyst of, *Oct.*, 1494
Ferments, pancreatic, tests for, *Feb.*, 10
Fetal adenomas, *Oct.*, 1306
Fibrocystic lesion of upper portion of shaft of femur, case report, *Dec.*, 1633
      differentiation, *Dec.*, 1641
      treatment, *Dec.*, 1637, 1641
First dorsal segment, extramedullary tumor of, *Dec.*, 1705
      laminectomy for, *Dec.*, 1706
Fistula, biliary, and cholecystectomy, *Aug.*, 1217
  fecal, postoperative appendical, *Aug.*, 1227
    tuberculous, *Aug.*, 1047, 1054
  from radium, *June*, 618
  rectovaginal, operation for, *June*, 867
  salivary, *June*, 911
  thoracic, with chronic left empyema, major thoracoplasty and lung mobilization in, *Dec.*, 1551
  umbilical, *Aug.*, 1037
Fistulas, gastrojejunocolic, following gastro-enterostomy, *Oct.*, 1241
      etiology, *Oct.*, 1242
Fistulas, gastrojejunocolic, following gastro-enterostomy, symptoms, *Oct.*, 1244
      treatment, *Oct.*, 1245
Fluoroscope, operating, *Aug.*, 1165, 1166
Foot, perforating ulcer of, *Aug.*, 1124
    amputation of thigh for, *Aug.*, 1113
    clinical picture, *Aug.*, 1124
    course, *Aug.*, 1124
    differential diagnosis, *Aug.*, 1128
    etiology, *Aug.*, 1124
    pathogenesis, *Aug.*, 1124
    prognosis, *Aug.*, 1128
    treatment, *Aug.*, 1128
Forceps, Duval's lung, *Oct.*, 1448
Forearm and thigh, cellulitis of, *Feb.*, 173
  fracture of, *June*, 899
    open reduction, *Feb.*, 175
Foreign bodies in thorax, removal of, *Oct.*, 1436
    swallowing of, *April*, 547
Fracture, compound, of both legs, *June*, 890
    of humerus, *June*, 900
  of base of skull, *June*, 594
  of femur, old, wearing Lane plate, *Aug.*, 1073
  of forearm, *June*, 899
    dressing in, *Feb.*, 175
    open reduction, *Feb.*, 175
  of jaw with deformity, *June*, 901
  of os calcis, *June*, 917
  of skull, *Feb.*, 59
    neurologic manifestations in, *Dec.*, 1709
      case reports, *Dec.*, 1714–1722
      compression due to edema in, *Dec.*, 1714
      concussion in, *Dec.*, 1712
      danger signs in, *Dec.*, 1713
      focal symptoms in, *Dec.*, 1716
      fundoscopic examination in, *Dec.*, 1722
      groups with no symptoms, *Dec.*, 1712
      irritative focal symptoms in, *Dec.*, 1717
      longitudinal sinus syndrome in, *Dec.*, 1720
      lumbar puncture in, *Dec.*, 1724
      paralytic symptoms, *Dec.*, 1718
      progressive intracranial compression symptoms in, *Dec.* 1713

- Fracture of skull, neurologic manifestations in, reflexes in, *Dec.*, 1715
    - symptoms produced by, *Dec.*, 1712
    - treatment, *Dec.*, 1723
  - of tibia, open reduction for, *Feb.*, 135
  - of vault of skull, *June*, 592
  - old, of patella, treatment, *Feb.*, 225
  - tarsal, old, *June*, 888
- Fractures, accurate anatomic reduction in, *Feb.*, 143
  - end-results in, *Feb.*, 141–149
  - multiple, of left upper extremities and shoulder girdle, *Dec.*, 1587
    - outlook, *Dec.*, 1591
    - procedure in, *Dec.*, 1587
    - tetanus antitoxin in, *Dec.*, 1588
  - of leg, method of applying extension with plaster cast fixation in, *Feb.*, 207
  - of spine, laminectomy for, revision of, *Dec.*, 1593
- Frontal sinusitis, chronic, observations in management, *Oct.*, 1381
  - operative treatment, *Oct.*, 1382
    - complications, *Oct.*, 1390
    - course after, *Oct.*, 1389
    - failure of, *Oct.*, 1391
- Fulguration in epithelioma of lip, *Feb.*, 203
- Fundoscopic examination in neurologic manifestations in fracture of skull, *Dec.*, 1722

- Gall-bladder, removal of, effect of, on metabolism, *April*, 543
- Ganglion, gasserian, alcohol injections of, *Feb.*, 124
  - tumors of, *Oct.*, 1350
- Gangrene, presenile, spontaneous, *Feb.*, 73
- Gangrenous pancreatitis, *Feb.*, 16, 20
- Gasserian ganglion, alcohol injections of, *Feb.*, 124
  - tumors of, *Oct.*, 1350
- Gastrectomy, partial, in penetrating ulcers of lesser curvature of stomach, *Dec.*, 1569
- Gastric neurosis, *June*, 927
  - ulcer, actual cautery in, *Oct.*, 1234
    - chronic, *April*, 367
- Gastroduodenal ulceration and diseased appendix, differential diagnosis, *April*, 534
- Gastro-enterostomy, gastrojejunocolic fistulas following, *Oct.*, 1241
    - etiology, *Oct.*, 1242
    - symptoms, *Oct.*, 1244
    - treatment, *Oct.*, 1245
  - Sims' position after, *April*, 299
- Gastrojejunocolic fistulas following gastro-enterostomy, *Oct.*, 1241
    - etiology, *Oct.*, 1242
    - symptoms, *Oct.*, 1244
    - treatment, *Oct.*, 1245
- Giant-cell sarcoma of lower end of radius, *Dec.*, 1747
- Glioma of brain, *Oct.*, 1349
- Goiter, exophthalmic, *April*, 261
  - intrathoracic, with secondary hyperthyroidism, *June*, 641
    - anesthesia for operation in, *June*, 651
    - basal metabolism in, *June*, 649
    - double pole ligation in, *June*, 650
    - operation for, *June*, 651
    - preoperative drugging in, *June*, 650
    - removal of adenoma, *June*, 655
    - symptoms, *June*, 646, 648
- Grafting razor, automatic, Hoffmann's, *Dec.*, 1657, 1659
  - spoon, *Dec.*, 1658, 1659
- Grant's operation in epithelioma of lip, *Feb.*, 204
- Gumma of brain, *Oct.*, 1350
- Gunshot wounds of thorax, *Oct.*, 1426

- "Hands off" technic in knee-joint operations, *Dec.*, 1611, 1612
- Hardening of head of pancreas, *Feb.*, 28
- Hat-pin, 5 cm. in length, swallowing of, 547
- Head injuries, *June*, 589
- Headache in tumors of brain, *Oct.*, 1350
- Hemangiomatous endothelioma of spleen, splenectomy for, *Feb.*, 235
- Hematogenous infection of pancreas, *Feb.*, 16
  - osteomyelitis, acute, of femur, *Dec.*, 1757
- Hematuria in hypernephroma of kidney, *Aug.*, 1019
- Hemolytic icterus, splenectomy in, *Aug.*, 1316
  - jaundice, splenectomy for, *June*, 909

Hemophiliac effusion into both knees, *Feb.*, 179
Hemorrhage in acute pancreatitis, *Feb.*, 15, 19
  intracranial, *June*, 598
  meningeal, lethargic encephalitis mistaken for, *Feb.*, 64
Hemorrhagic cyst of upper left femur, *Oct.*, 1493
    right femur, *Oct.*, 1494
  pancreatitis, *Feb.*, 13, 15, 16
Hemorrhoids, *Feb.*, 167
  ligation of, *Feb.*, 157
  primary, *Feb.*, 167
  secondary, *Feb.*, 167
  sites for, *Feb.*, 167
Hereditary deforming chondroplasia, *Feb.*, 250
Hernia, femoral, varix in Scarpa's triangle simulating, *Dec.*, 1673
  inguinal traumatic (?), *Dec.*, 1573
    Bassini's modified technic in, *Dec.*, 1578
    degrees of, *Dec.*, 1574
    first degree, *Dec.*, 1574
    fourth degree, *Dec.*, 1574
    operation for, *Dec.*, 1578
    physique in, *Dec.*, 1575
    postoperative course, *Dec.*, 1579
    recurrence in, *Dec.*, 1580
    relation of trauma to production of, *Dec.*, 1574
    repeated acts of violence in, *Dec.*, 1574, 1576, 1578
    second degree, *Dec.*, 1574
    single act of violence in, *Dec.*, 1574, 1575, 1578
    spontaneous cure in, *Dec.*, 1577
    third degree, *Dec.*, 1574
    type of violence in, *Dec.*, 1576
  of diaphragm, operative treatment, *Oct.*, 1437
  of posterior vaginal wall, plastic operations for, *Feb.*, 90–100
  relation of injury to production of, *Dec.*, 1574
  umbilical, *Feb.*, 161
High enterostomy, *Dec.*, 1671
  rationale of, *Dec.*, 1672
Hip and femur, plastic surgery, *April*, 391
  arthritis of, *June*, 910
  congenital dislocation of, unexpected end-results following treatment, *June*, 681
  dislocation of, Denuce's method of reduction, *June*, 692
  recurrent posterior dislocation, *Feb.*, 151
  tuberculosis of, *Aug.*, 1073
Hip, tuberculous osteitis of, *April*, 412
    treatment, *April*, 413
Hirsch's method of care of amputation stump, *Aug.*, 1149
Hirschsprung's disease, *Aug.*, 1047
Hodgkin's disease, radium and *x*-ray in, *Oct.*, 1327
Hoffmann's automatic grafting razor, *Dec.*, 1657, 1659
Hour-glass formation in penetrating ulcers of lesser curvature of stomach, *Dec.*, 1566
Humerus, chondro-osteoma of, *Frb.*, 253
  compound fracture of, *June*, 900
  lower end, pulsating, central sarcoma of, *Feb.*, 67
  osteochondroma of, *Feb.*, 253
Hydatid cyst of liver, *Feb.*, 37
    Santoni's sign in, *Feb.*, 40
Hypernephroma of kidney, *Aug.*, 1013
    differential diagnosis, *Aug.*, 1021
    hematuria in, *Aug.*, 1019
    physical examination in, *Aug.*, 1020
    symptoms, *Aug.*, 1019
    treatment, *Aug.*, 1022
Hyperthyroidism, primary, *June*, 647
  secondary, *June*, 647
    with intrathoracic goiter, *June*, 641

ICTERUS, hemolytic, splenectomy in, *Oct.*, 1316
Ileac intussusception, *Aug.*, 1087
Ileocecal intussusception, *Aug.*, 1087
Ileocolic intussusception, *Aug.*, 1087
    protruding through anus, *Aug.*, 1083
Ileus complicating appendicitis, high enterostomy for, *Dec.*, 1663
      technic, *Dec.*, 1666
Incision, Albarran, for exposure of kidney, *April*, 446
  Corner's, *Oct.*, 1486
  for arthroplasty of knee-joint, *Oct.*, 1489
  for resection of knee-joint, *Oct.*, 1489
  in knee-joint, *Oct.*, 1483
    anterior internal and anterior external, *Oct.*, 1484
    external posterior lateral and internal posterior lateral, *Oct.*, 1487
    split patella incision, *Oct.*, 1486
Incomplete abortion, *Feb.*, 163
Infantile paralysis, orthopedic treatment, *Aug.*, 1069

Infection in etiology of pancreatitis, *Feb.*, 27
Inflammation, non-tuberculous, of cecum, *April*, 361
Inguinal hernia, traumatic(?), *Dec.*, 1573
    Bassini's modified technic in, *Dec.*, 1578
    degrees of, *Dec.*, 1574
    first degree, *Dec.*, 1574
    fourth degree, *Dec.*, 1574
    operation for, *Dec.*, 1578
    physique in, *Dec.*, 1575
    postoperative course, *Dec.*, 1579
    recurrence in, *Dec.*, 1580
    relation of trauma to production of, *Dec.*, 1574
    repeated acts of violence in, *Dec.*, 1574, 1576, 1578
    second degree, *Dec.*, 1574
    single act of violence in, *Dec.*, 1574, 1575, 1578
    spontaneous cure in, *Dec.*, 1577
    third degree, *Dec.*, 1574
    type of violence in, *Dec.*, 1576
Injuries of head, *June*, 589
Inoperable cancer of cervix, radium in treatment of, *June*, 615
Interacinar chronic interstitial pancreatitis, *Feb.*, 27
  pancreatitis, chronic, *Feb.*, 26
Interlobular pancreatitis, chronic, *Feb.*, 26
    pathology of, *Feb.*, 26
Intestine, large, adenocarcinoma of, *Aug.*, 1047, 1064
    carcinoma of, symptomatology, *June*, 739
    tumors of, *Aug.*, 1047
Intra-acinar chronic interstitial pancreatitis, *Feb.*, 27
Intracranial hemorrhage, *June*, 598
Intradural encapsulated metastatic adenocarcinoma attached to cervical cord, *Dec.*, 1679
Intrathoracic goiter, with secondary hyperthyroidism, *June*, 641
Intussusception, colic, *Aug.*, 1087
  double, *Aug.*, 1088
  enteric, *Aug.*, 1087
  ileac, *Aug.*, 1087
  ileoceal, *Aug.*, 1087
  ileocolic, *Aug.*, 1087
    protruding through anus, *Aug.*, 1083
  triple, *Aug.*, 1088
  types of, *Aug.*, 1087
Intussuscipiens, *Aug.*, 1088
Irritable knee, *Dec.*, 1611
Islands of Langerhans, *Feb.*, 7

JAUNDICE, hemolytic, splenectomy for, *June*, 909
  in biliary disease, causation, *April*, 536
Jaw, cystic tumors of, classification, *Feb.*, 257
  fracture of, with deformity, *June*, 901
  lower, adamantinoma of, *Feb.*, 255
    multilocular cyst of, *Feb.*, 255
Jejunostomy as palliative measure in inoperable cancer of stomach, case report, *Dec.*, 1619, 1627
  in ulcers of stomach, value of, case report, *Dec.*, 1619
  technic, *Dec.*, 1630
Joint empyema, types, *Dec.*, 1604
Jones', Robert, operation in semilunar cartilage injuries, *Dec.*, 1612

KIDNEY, exposure of, Albarran incision for, *April*, 446
  cases, infected, surgical technic in, *April*, 445
  hypernephroma of, *Aug.*, 1013
    differential diagnosis, *Aug.*, 1021
    hematuria in, *Aug.*, 1019
    physical examination in, *Aug.*, 1020
    symptoms, *Aug.*, 1019
    treatment, *Aug.*, 1022
  pus in, technic for evacuating, *April*, 446
  stone in, *June*, 833. See also *Renal calculus.*
  tuberculosis of, associated with renal calculus, *June*, 857
Klumpke-Déjerine syndrome in brachial plexus injury, *April*, 578
Knee cases, reconstruction clinic for, *June*, 875–882
  irritable, *Dec.*, 1611
  tuberculosis of, *June*, 655, 916
    amputation of thigh for, *Aug.*, 1130
    excision of knee in, *June*, 667
    indications for operation in, *Aug.*, 1136
    operation for, *June*, 679
    treatment, *June*, 679
Knee-joint, angioma of, *June*, 681
    operation for, *June*, 684
  arthroplasty of, incision for, *Oct.*, 1489
  crucial ligaments of, *Dec.*, 1598
  incisions in, *Oct.*, 1483
    anterior internal and anterior external, *Oct.*, 1484

Knee-joint, incisions in, external posterior lateral and internal posterior lateral, *Oct.*, 1487
  split patella, *Oct.*, 1486
 injuries, *Dec.*, 1597
  crucial ligaments in, *Dec.* ,1599
  frequency of, *Dec.*, 1597
  operation, *Dec.*, 1611
  order of frequency, *Dec.*, 1609
  semilunar fibrocartilages in, *Dec.*, 1599
  structure in, *Dec.*, 1597
  treatment, *Dec.*, 1610
   non-operative, *Dec.*, 1610
   operative, *Dec.*, 1610
  x-ray examination in, *Dec.*, 1610
 laparatomy of, *Dec.*, 1613
 loose bodies about, *June*, 875; *Dec.*, 1614
   diseases associated with, *Dec.* 1615
   from traumatic sources, *Dec.*, 1615
   incidence of, *Dec.*, 1615
   number of, *Dec.*, 1615
   pain in, *Dec.*, 1616
   symptoms, *Dec.*, 1616
   treatment, *Dec.*, 1617
   x-ray examination in, *Dec.*, 1617
 periosteal sarcoma involving, *Oct.*, 1500
 resection of, incision for, *Oct.*, 1489
 semilunar fibrocartilages of, *Dec.*, 1599
 structure of, *Dec.*, 1598
Knees, effusion into both, in hemophilia, *Feb.*, 179
  in syphilis, *Feb.*, 179
Kondoleon operation for elephantiasis, *Oct.* , 1527, 1528
Krüger's method of treating nerves in amputation of thigh, *Aug.*, 1147
Kummel's disease, *Dec.*, 1581. See also *Spondylitis, traumatic.*

Laceration of brain, *June*, 596
Laminectomy, *Aug.*, 973
 and radical excision of tumor in cervical cord tumor, *Dec.*, 1699
 and removal of extramedullary tumor at first dorsal segment, *Dec.*, 1705
 for fractured spine, revision of, *Dec.*, 1593
   operation, *Dec.*, 1594
   outlook, *Dec.*, 1595
 in endothelioma of conus and cauda equina, *Dec.*, 1688
Laminectomy in lumbar region for traumatic paraplegia, *Aug.*, 1185
Lane plate in old fracture of femur, *Aug.*, 1073
Langerhans, islands of, *Feb.*, 7
Laparotomy of knee-joint, *Dec.*, 1613
Leather-bottle stomach, *Aug.*, 1178, 1183
Leg and second metacarpal bone, tuberculosis of lymphatic vessels of, *April*, 473
 artificial, temporary, method of constructing, *Aug.*, 1151
 compound fracture of, *June*, 890
 fracture of, method of applying extension with plaster cast fixation in, *Feb.*, 207
Leontiasis ossea, *Feb.*, 53, 56
Lethargic encephalitis mistaken for meningeal hemorrhage, *Feb.*, 65
Leukemia, splenomyelogenous, splenectomy in, *Oct.*, 1321
Ligament of Treitz, *April*, 506
Ligation of hemorrhoids, *Feb.*, 167
 of inferior thyroid artery and vein, Dequervain's method, *Aug.*, 981
   local anesthesia in, *Aug.*, 981
Linitis plastica, *Aug.* ,1178, 1183
Lip, epithelioma of, *Feb.*, 197
  fulguration in, *Feb.*, 203
  Grant's operation in, *Feb.*, 204
  radium in, *Feb.*, 204
  treatment, *Feb.*, 203
Lipase, *Feb.*, 10
Lipoma arborescens of ankle-joint, *Aug.*, 1213
 retroperitoneal, *Oct.*, 1451
  clinical data, *Oct.*, 1451
  degenerating, *Oct.*, 1454
  diagnosis of, *Oct.*, 1455
  etiology of, *Oct.*, 1457
  microscopic findings in, *Oct.*, 1464
  operation for, mortality, *Oct.*, 1460
  pathologic findings in, *Oct.*, 1460
Lisfranc amputation, *June*, 714
Lithiasis, renal, and chronic nephritis with anuria, *April*, 443
 urinary, complications of, *April*, 423
Liver, hydatid cyst of, *Feb.*, 37
   Santoni's sign in, *Feb.*, 40
Lobectomy, single-stage, in suppurative bronchiectasis, *Dec.*, 1541
Localized serous meningitis, *Dec.*, 1594
Longitudinal sinus syndrome in neurologic manifestations in fracture of skull, *Dec.*, 1720

- Loose bodies about knee-joint, *June*, 875; *Dec.*, 1614
    - diseases associated with, *Dec.*, 1615
    - from traumatic sources, *Dec.*, 1615
    - incidence of, *Dec.*, 1615
    - number of, *Dec.*, 1615
    - pain in, *Dec.*, 1616
    - symptoms, *Dec.*, 1616
    - treatment, *Dec.*, 1617
    - *x*-ray examination in, *Dec.*, 1617
- Lumbar puncture in neurologic manifestations in fracture of skull, *Dec.*, 1724
- Lung, abscess of, *June*, 765
    - age in etiology of, *June*, 767
    - anesthesia for operation in, *June*, 778
    - diagnosis, *June*, 768
    - due to removal of tonsils, *June*, 766
    - etiology, *June*, 765
    - history taking in, *June*, 768
    - mortality in, *June*, 777
    - operation in, *June*, 778
    - physical examination in, *June*, 774
    - prognosis in, *June*, 777
    - situation of, *June*, 768
    - sputum examination in, *June*, 769
    - surgical treatment, *Oct.*, 1430
    - *x*-ray examination in, *June*, 771
  - forceps, Duval's, *Oct.*, 1448
  - mobilization and major thoracoplasty in chronic left empyema with thoracic fistula, *Dec.*, 1551
- Lymphangitic pancreatitis, chronic, *Feb.*, 26
- Lymphangitis, pancreatic, *Feb.*, 5, 12
- Lymphatic system of pancreas, *Feb.*, 5
  - vessels of leg and second metacarpal bone, tuberculosis of, *April*, 1473
- Lymphatics of female breast in relation to cancer of breast, *Aug.*, 1025

- MAJOR neuralgia, *Feb.*, 101. See also *Trigeminal neuralgia.*
  - thoracoplasty and lung mobilization in chronic left empyema with thoracic fistula, *Dec.*, 1551
- Mal perforant du pied, *Aug.*, 1124
    - amputation of thigh for, *Aug.*, 1113
    - clinical picture, *Aug.*, 1124
    - course, *Aug.*, 1124
- Mal perforant du pied, differential diagnosis, *Aug.*, 1128
    - etiology, *Aug.*, 1124
    - pathogenesis, *Aug.*, 1124
    - prognosis, *Aug.*, 1128
    - treatment, *Aug.*, 1128
- Malignant bone cyst, *Feb.*, 70
  - tumors of thyroid, *Oct.*, 1291
- Maltase, *Feb.*, 10
- Mammary gland, tuberculosis of, *June*, 919
- Mastitis, chronic suppurative, *April*, 277
- Mediastinum, dermoid cyst of, extirpation of, *Dec.*, 1531
- Medulla, endothelioma of, giant, *Dec.*, 1693
    - diagnosis, *Dec.*, 1694
    - indication for and plan of operation, *Dec.*, 1694
    - operation, *Dec.*, 1695
    - postoperative course, *Dec.*, 1697
- Megacolon, *Aug.*, 1047
- Meningeal hemorrhage, lethargic encephalitis mistaken for, *Feb.*, 65
- Meningitis, localized serous, *Dec.*, 1594
- Menorrhagia, non-malignant, radium in treatment of, *June*, 620
- Menstruatio præcox, *June*, 614
- Metabolic changes of Paget's disease of bones, *Feb.*, 57
- Metabolism, basal, *June*, 649
  - effect of removal of gall-bladder on, *April*, 543
- Metastatic adenocarcinoma, intradural encapsulated, attached to cervical cord, *Dec.*, 1679
      - division of anterolateral tract, *Dec.*, 1684
      - operation, *Dec.*, 1682
      - postoperative course, *Dec.*, 1684
- Mobilization of lung and major thoracoplasty in chronic left empyema with thoracic fistula, *Dec.*, 1551
- Mornard's investigations on relation of lymphatics of breast, *Aug.*, 1029
- Mouth, floor of, cancer of, *June*, 907
- Mouvements supplées, *April*, 565
- Multilocular cyst of lower jaw, *Feb.*, 255
- Multiple cartilaginous exostoses, *Feb.*, 249
  - postperitoneal cystomata, *June*, 607
  - resection of ribs with collapse of chest for pulmonary tuberculosis, *Dec.*, 1557

Murphy button in gastric resection, *Dec.*, 1570
Musculospiral nerve, suture of, *April*, 339
Myxoliposarcoma, retroperitoneal, *Dec.*, 1796

Necrosis, fat, in acute pancreatitis, *Feb.*, 13, 14, 19
  partial, of coccyx, *Aug.*, 1215
Needles, embedded, removal of, in broad daylight with intermittent fluoroscopic control, *Aug.*, 1163
Nephrotomy and decapsulation for anuria, *April*, 432
  in renal calculus, *June*, 859, 860
Nerve, musculospiral, suture of, *April*, 339
  pattern, *June*, 731
  regeneration, *April*, 585
  supply of pancreas, *Feb.*, 6
  trigeminal, function of, *Feb.*, 102
    origin and distribution, *Feb.*, 101
  ulnar, suture of, *June*, 903
Neuralgia, epileptiform, *Feb.*, 106
  major, *Feb.*, 101. See also *Trigeminal neuralgia.*
  Sluder's, *Feb.*, 106
  surgical, *Feb.*, 106
  trigeminal, *Feb.*, 101
    alcohol injections in, *Feb.*, 108, 117
    etiology of, *Feb.*, 107
    forms of, *Feb.*, 103
    operation for, *Feb.*, 110–114
      complications after, *Feb.*, 116
      end-results after, *Feb.*, 117
    symptoms of, *Feb.*, 107
    toxic, *Feb.*, 104
    treatment of, *Feb.*, 108
Neurofibroma of brain, *Oct.*, 1347
Neurologic manifestations in fracture of skull, *Dec.*, 1709
    case reports, *Dec.*, 1714–1722
    compression due to edema in, *Dec.*, 1714
    concussion in, *Dec.*, 1712
    danger signs in, *Dec.*, 1713
    focal symptoms in, *Dec.*, 1716
    fundoscopic examination in, *Dec.*, 1722
    groups with no symptoms, *Dec.*, 1712
    irritative focal symptoms in, *Dec.*, 1717
    longitudinal sinus syndrome in, *Dec.*, 1720
    lumbar puncture in, *Dec.*, 1724
Neurologic manifestations in fracture of skull, paralytic symptoms in, *Dec.*, 1718
    progressive intracranial compression symptoms in, *Dec.*, 1713
    reflexes in, *Dec.*, 1715
    symptoms produced by, *Dec.*, 1712
    treatment, *Dec.*, 1723
Neurolysis of brachial plexus, *Feb.*, 127
Neuroma of amputation stump, *June*, 903
Neurosis, gastric, *June*, 927
Neurotomy in treatment of spastic paralysis, *June*, 729
Non-malignant menorrhagia, radium in treatment, *June*, 620
Nuclease, *Feb.*, 10

Obstetric paralysis from injury of brachial plexus, *April*, 574
Ocular phenomena in chiasmal lesions not of pituitary origin, *Oct.*, 1363
Oddi, sphincter of, *Feb.*, 8
Omentum, use of attached transplants of, in peritoneal cavity, *Oct.*, 1468
    of free transplants of, in peritoneal cavity, *Oct.*, 1466
Operating fluoroscope, *Aug.*, 1165, 1166
Orthopedic cases, *Aug.*, 1069
Os calcis, fracture of, *June*, 917
Osteitis deformans, *Feb.*, 47
    metabolic changes of, *Feb.*, 57
    tumor-forming, *Feb.*, 57
  fibrosa cystica, *Feb.*, 57; *Dec.*, 1773
  of wrist, traumatic, *June*, 697
  tuberculous, of hip, *April*, 412
    treatment, *April*, 413
Osteochondroma of femur, *Feb.*, 251
  of humerus, *Feb.*, 253
Osteomalacia, *Oct.*, 1497
Osteomyelitis, *June*, 628
  chronic, *April*, 345
    traumatic, *Dec.*, 1773
  of femur, acute hematogenous, *Dec.*, 1757
  of tibia with transposition of fibula, *Aug.*, 1078
  operation in, *June*, 632
Osteoplastic flap in operations for tumors of brain, *Oct.*, 1357
Osteosarcoma of clavicle, *Dec.*, 1789
Ovary, cystic, *Feb.*, 159
    adenoma of, *Arpil*, 267
Oxygen injection of knee-joint in synovitis, *Dec.*, 1601

Paget's disease of bones, *Feb.*, 47
    metabolic changes of, *Feb.*, 57
Pain in acute conditions of abdomen, *Oct.*, 1473
  in chronic appendicitis, *April*, 523, 524
  in tumors of brain, *Oct.*, 1351
Palmar tendon sheaths, tuberculosis of, *June*, 905
Pancreas, accessory, 2
  acini of, *Feb.*, 7
  anatomy of, *Feb.*, 2
  blood-supply of, *Feb.*, 4
  body of, *Feb.*, 3
  cirrhosis of, *Feb.*, 26
  duct system of, *Feb.*, 7
  hardening of head, *Feb.*, 28
  head of, *Feb.*, 3
    hardening, *Feb.*, 28
  hematogenous infection, *Feb.*, 16
  lymphatic system of, *Feb.*, 5
  neck of, *Feb.*, 3
  nerve supply of, *Feb.*, 6
  pseudocysts of, *Feb.*, 22
  tail of, *Feb.*, 4
  triangle of infection, *Feb.*, 28
Pancreasvergiftung, *Feb.*, 13, 20
Pancreatic disease, pathogenesis, *Feb.*, 11
  ferments, tests for, *Feb.*, 10
  juice, *Feb.*, 9
  lymphangitis, *Feb.*, 5, 12
  tissue, aberrant, *Feb.*, 2
Pancreatitic apoplexy, *Feb.*, 18
Pancreatitis, *Feb.*, 1
  acute, *Feb.*, 13
    diagnosis of, *Feb.*, 21
    fat necrosis in, *Feb.*, 13, 14, 19
    hemorrhage in, *Feb.*, 15, 19
    operative treatment, *Feb.*, 23
    treatment of, *Feb.*, 23
  chronic, *Feb.*, 25
    classification of, *Feb.*, 26
    interacinar, *Feb.*, 26
    interlobular, *Feb.*, 26
      pathology of, *Feb.*, 26
    interstitial, interacinar, *Feb.*, 27
      intra-acinar, *Feb.*, 27
    lymphangitic, *Feb.*, 26
  developmental processes, *Feb.*, 1
  drainage in, *Feb.*, 34
  gangrenous, *Feb.*, 16, 20
  hemorrhagic, *Feb.*, 13, 15, 16
  infection in etiology of, *Feb.*, 27
  interacinar, chronic, *Feb.*, 26
  interlobular, chronic, *Feb.*, 26
      pathology of, *Feb.*, 26
  lymphangitic, chronic, *Feb.*, 26
  pathogenesis of, *Feb.*, 11
Pancreatitis, suppurative, secondary, *Feb.*, 16, 20
  symptoms of, *Feb.*, 21
Papillo-edema in tumors of brain, *Oct.*, 1351
Paralysis, Aran-Duchenne type, in injury of brachial plexus, *April*, 579
  from stab wound of brachial plexus, *April*, 563
  infantile, orthopedic treatment, *Aug.*, 1069
  obstetric, from injury of brachial plexus, *April*, 574
  spastic, *June*, 729
    causes, *June*, 730
    methods of surgical approach in, *June*, 730
    neurotomy in treatment of, *June*, 729
    Stoffel operation for, *June*, 729, 731–733
Paraplegia, traumatic, laminectomy in lumbar region for, *Aug.*, 1185
Paravertebral anesthesia in thoracotomy, *Oct.*, 1444–1446
Parotid gland, tumors of, *Oct.*, 1515
    treatment, *Oct.*, 1516–1521
Patella, fracture of, old, treatment of, *Feb.*, 225
  incision, split, *Oct.*, 1486
Patent urachus, escape of urine or pus from, *Aug.*, 1044
Pelvis, renal, potential perforation, *April*, 461, 467
      plastic repair for, *April*, 464
Peptic ulcer, *June*, 927
Perforating ulcer of foot, *Aug.*, 1124
    amputation of thigh for, *Aug.*, 1113
    clinical picture, *Aug.*, 1124
    course, *Aug.*, 1124
    differential diagnosis, *Aug.*, 1128
    etiology, *Aug.*, 1124
    pathogenesis, *Aug.*, 1124
    prognosis, *Aug.*, 1128
    treatment, *Aug.*, 1128
Perforation in acute appendicitis, *April*, 553, 554
  of ureter, *April*, 455
    with abscess, *April*, 459
  of urinary tract, *April*, 440
  potential, of kidney, *April*, 461
    of renal pelvis, *April*, 461, 467
      plastic repair for, *April*, 464
Pericarditis, primary tuberculous, *Oct.*, 1411
    abstract of 8 cases reported in literature since 1897, 1420

Pericarditis, primary tuberculous, case illustrating, *Oct.*, 1413
    surgical treatment, *Oct.*, 1418
  purulent, operative treatment, *Oct.*, 1437
Periosteal sarcoma involving knee-joint, *Oct.*, 1500
Peripheral nerve, anatomy of, *April*, 584
Perirenal urinary extravasation, *April*, 444
Peritoneal cavity, transplantation of fat in, *Oct.*, 1465
    use of attached transplants of omentum in, *Oct.*, 1468
      of free transplants of omentum in, *Oct.*, 1466
Peritonitis, pneumococcus, *April*, 307
    blood examination in, *April*, 312
    clinical types, *April*, 313
    etiology of, *April*, 311
    symptoms of, *April*, 311
    treatment of, *April*, 313
Pernicious anemia, splenectomy in, *Oct.*, 1314
Phenolsulphonephthalein test in renal calculus, *June*, 841
Piles, *Feb.*, 167
  ligation of, *Feb.*, 167
  primary, *Feb.*, 167
  secondary, *Feb.*, 167
  sites for, *Feb.*, 167
Pirogoff amputation, *June*, 714
Pituitary body, tumors of, *Oct.*, 1350
Plastic operation for large empyema cavity, *Aug.*, 1219
  operations applied to anterior and posterior vaginal wall, *Feb.*, 90–100
    for cystocele, *Feb.*, 90–100
  repair for potential renal pelvic perforation, *April*, 464
  surgery of hip and femur, *April*, 391
Plexus, brachial, neurolysis of, *Feb.*, 127
  solaris, *Feb.*, 6
Pneumococcus peritonitis, *April*, 307
    clinical types, *April*, 313
    examination of blood in, *April*, 312
    etiology, *April*, 311
    symptoms, *April*, 311
    treatment, *April*, 313
Pneumothorax, artificial, in suppurative bronchiectasis, *Dec.*, 1542
Pointe pancréatique, *Feb.*, 32
Poliomyelitis, anterior, orthopedic treatment, *Aug.*, 1069
Polycythemia, primary, splenectomy in, *Oct.*, 1318
Pool's operation for cervical rib, *April*, 325
Postoperative appendical fecal fistula, *Aug.*, 1227
  treatment, importance of posture in, *April*, 283
    Sims' posture in, *April*, 294
    slight Trendelenburg posture in, *April*, 284
Postperitoneal multiple cystomata, *June*, 607
Posture, importance of, in postoperative treatment, *April*, 283
  Sims', after operations, *April*, 294
  Trendelenburg, slight, after operations, *April*, 284
Potential perforations of kidney, *April*, 461
    of renal pelvis, *April*, 461, 467
      plastic repair for, *April*, 464
Pregnancy at term, acute appendicitis in, *Aug.*, 1003
Presenile spontaneous gangrene, *Feb.*, 73
Prolapse of uterus, *Feb.*, 77
    analysis of symptoms, *Feb.*, 83
    complete, *Feb.*, 80
    partial, *Feb.*, 80
    type of operations for, *Feb.*, 85
Prosecretin, *Feb.*, 9
Prostate, carcinoma of, discovered at operation, prognosis in, *Oct.*, 1279
    types, *Oct.*, 1283
Protrypsin, *Feb.*, 13
Pseudarthroses, *June*, 892
Pseudocysts of pancreas, *Feb.*, 22
Pseudoprolapsus uteri, *Feb.*, 80
Ptosis, see *Hernia*.
Pulmonary tuberculosis, multiple resection of ribs with collapse of chest for, *Dec.*, 1557
Pulsating central sarcoma of lower end of humerus, *Feb.*, 67
Purulent pericarditis, operative treatment, *Oct.*, 1437
  synovitis, types, *Dec.*, 1604
Pus, escape of, from patent urachus, *Aug.*, 1044
  in kidney, technic for evacuating, *April*, 446
  in urine in renal calculus, *June*, 838
Pyelitis, bleeding, *Aug.*, 1022
  follicularis, *Aug.*, 1022
Pyelotomy in renal calculus, *June*, 859
Pylephlebitis of appendical origin simulating lung abscess, *Aug.*, 1093
Pyloric end of stomach, cancer of, local anesthesia in operating for, *Aug.*, 945

Pyloric stenosis, congenital hypertrophic, *June*, 797
    duodenal tube in diagnosis, *June*, 804
    ether anesthesia for pyloroplasty in, *June*, 799, 805
    mortality in, following pyloroplasty, *June*, 806
    pyloroplasty in, *June*, 798–800, 805
    x-ray in diagnosis, *June*, 804
  syndrome in chronic appendicitis, *April*, 519, 523, 524
Pyloroplasty in congenital hypertrophic pyloric stenosis, *June*, 798–800
Pylorospasm, reflex, in chronic appendicitis, *April*, 524

RADIUM, fistula from, *June*, 618
  in cancer of cervix uteri, *June*, 615
    of lower end of esophagus, *Dec.*, 1734
  in epithelioma, *Dec.*, 1643
    of lip, *Feb.*, 204
  in Hodgkin's disease, *Oct.*, 1327
  in inoperable cancer of cervix, *June*, 615
  in non-malignant menorrhagia, *June*, 620
  in rhinoscleroma, *Oct.*, 1397
  in sarcoma, *Dec.*, 1802, 1803
  in tumors of brain, *Oct.*, 1360
Radius, lower end, giant-cell sarcoma of, *Dec.*, 1747
Recklinghausen's disease, *Feb.*, 57
Reconstruction clinic, *June*, 873
    knee cases, *June*, 875–882
Rectocele, surgical treatment, *Feb.*, 82
Rectosigmoid juncture, carcinoma of, symptomatology, *June*, 754
Rectovaginal fistula, operation for, *June*, 867
Rectum, carcinoma of, *April*, 353
  stricture of, *Aug.*, 1047, 1056
Reflex anuria that responds to ureteral catheterization, *April*, 437
    ureteral calculus with, *April*, 436
  pylorospasm in chronic appendicitis, *April*, 524
  suppression of urine due to impacted ureteral calculus requiring ureterotomy, *April*, 438
Regeneration of nerves, *April*, 585
Renal calculus, *June*, 833
    age incidence in, *June*, 834
    chemical examination of stones removed, *June*, 847
Renal calculus, duration of symptoms in, *June*, 835
    frequency of urination in, *June*, 838
    nephrotomy in, *June*, 859, 860
    occupation of patients, *June*, 838
    pain in, *June*, 837
    phenolsulphonephthalein test in, *June*, 841
    postoperative complications, *June*, 847
    pus in urine in, *June*, 838
    pyelotomy in, *June*, 859
    renal tuberculosis associated with, *June*, 857
    urinary findings in, *June*, 838
    x-rays in diagnosis, *June*, 839
  lithiasis and chronic nephritis with anuria, *April*, 433
  pelvis, potential perforation, *April*, 461, 467
      plastic repair for, *April*, 464
  tuberculosis associated with renal calculus, *June*, 857
Resection of knee-joint, incision for, *Oct.*, 1489
Retroperitoneal fluid, escape of, from umbilicus, *Aug.*, 1044
  lipoma, *Oct.*, 1451
    clinical data, *Oct.*, 1451
    degenerating, *Oct.*, 1454
    diagnosis, *Oct.*, 1455
    etiology, *Oct.*, 1457
    microscopic findings in, *Oct.*, 1464
    operation for, *Oct.*, 1458
      mortality, *Oct.*, 1460
    pathologic findings in, *Oct.*, 1460
  myxoliposarcoma, *Dec.*, 1796
  periureteral extravasation of urine, *April*, 450
  sarcoma, *Dec.*, 1789
Rhinophyma, *Oct.*, 1393
Rhinoscleroma, *Oct.*, 1393
  radium in, *Oct.*, 1397
Rib, cervical, operation for removal, *April*, 325
    Pool's operation for, *April*, 325
    Taylor's operation for, *April*, 337
Ribs, multiple resection of, with collapse of chest for pulmonary tuberculosis, *Dec.*, 1557
Ritter's method of treating nerves in amputation of thigh, *Aug.*, 1146

SACRO-ILIAC joint, tuberculosis of *June*, 703
    arthrodesis for, *June*, 704
Salivary fistula, *June*, 911
  gland of abdomen, *Feb.*, 16

Santoni's sign in hydatid cyst of liver, *Feb.*, 40
Santorini, duct of, *Feb.*, 2, 8
Sarcoma, giant-cell, of lower end of radius, *Dec.*, 1747
  of bone, *Feb.*, 67
  of brain, *Oct.*, 1350
  of clavicle, *Dec.*, 1789
  of scapula, *Dec.*, 1789
  of tibia, *Dec.*, 1789
  periosteal, involving knee-joint, *Oct.*, 1500
  pulsating central, of lower end of humerus, *Feb.*, 67
  radium in, *Dec.*, 1802, 1803
  retroperitoneal, *Dec.*, 1789
  x-ray in treatment after excision, *Dec.*, 1800
Scapula and long bones, enchondroma of, *Feb.*, 249
  enchondroma of, *Feb.*, 243
  sarcoma of, *Dec.*, 1789
Scar excision, *June*, 904
Scarpa's triangle, varix in, simulating femoral hernia, *Dec.*, 1673
Scrotum, implantation of testicle in, for ectopic testicle, *Feb.*, 231
Secondary hyperthyroidism with intrathoracic goiter, *June*, 641
Secretin, *Feb.*, 9
Semilunar fibrocartilages, *Dec.*, 1599
    injury of, *Dec.*, 1607
      and crucial ligament injuries, differentiation, *Dec.*, 1609
      causes, *Dec.*, 1608
      grades of, *Dec.*, 1609
      operation, *Dec.*, 1611
      Robert Jones' operation in, *Dec.*, 1612
      symptoms, *Dec.*, 1608
      treatment, *Dec.*, 1610
Shoulder, birth injury of, *Feb.*, 127
  dislocation of, old posterior, *Dec.*, 1739
    posterior, production of, *Dec.*, 1740
      types of, *Dec.*, 1740
    recurrent, *June*, 882
  girdle and left upper extremities, multiple fractures of, *Dec.*, 1587
Sigmoid, diverticulitis of, mistaken for cancer, *Aug.*, 1047, 1053
  flexure, carcinoma of, symptomatology, *June*, 751
Sigmoiditis, chronic, in patient with left inguinal hernia, *Aug.*, 1047, 1052
Sign, Santoni's, in hydatid cyst of liver, *Feb.*, 40
Silent abdomen, *Oct.*, 1479, 1481
Silver foil dressing in skin-grafting, *Dec.*, 1662
Sims' posture after operations, *April*, 294
Single-stage lobectomy in suppurative bronchiectasis, *Dec.*, 1541
Sinusitis, frontal, chronic, observations in management, *Oct.*, 1381
      operative treatment, *Oct.*, 1382
        complications, *Oct.*, 1390
        course after, *Oct.*, 1389
        failure of, *Oct.*, 1391
Skin fixation instrument, automatic, *Dec.*, 1658
Skin-grafting, Thiersch, *Dec.*, 1650
    after-treatment, *Dec.*, 1662
    anesthetizing area in, *Dec.*, 1655
    placing of graft, *Dec.*, 1658
    preparation of surface for, *Dec.*, 1652
    silver foil dressing for, *Dec.*, 1662
    technic of cutting graft, *Dec.*, 1655
Skull, base of, fracture of, *June*, 594
  fracture of, *Feb.*, 59
    neurologic manifestations in, *Dec.*, 1709
      case reports, *Dec.*, 1714–1722
      compression due to edema in, *Dec.*, 1714
      concussion in, *Dec.*, 1712
      danger signs in, *Dec.*, 1713
      focal symptoms in, *Dec.*, 1716
      fundoscopic examination in, *Dec.*, 1722
      groups with no symptoms, *Dec.*, 1712
      irritative focal symptoms in, *Dec.*, 1717
      longitudinal sinus syndrome in, *Dec.*, 1720
      lumbar puncture in, *Dec.*, 1724
      paralytic symptoms in, *Dec.*, 1718
      progressive intracranial compression symptoms in, *Dec.*, 1713
      reflexes in, *Dec.*, 1715
      symptoms produced by, *Dec.*, 1712
      treatment, *Dec.*, 1723
  vault of, fracture of, *June*, 592
Sluder's neuralgia, *Feb.*, 106
Spastic paralysis, *June*, 729
    causes, *June*, 730
    methods of surgical approach in, *June*, 730

Spastic paralysis, neurotomy in treatment of, *June*, 729
  Stoffel operation for, *June*, 729, 731–733
Sphincter of Oddi, *Feb.*, 8
Spine, fracture of, laminectomy for, revision of, *Dec.*, 1593
  of tibia, injury of, *Dec.*, 1613
    treatment, *Dec.*, 1614
  tuberculosis of, *Aug.*, 1076
Spleen, hemangiomatous endothelioma of, splenectomy for, *Feb.*, 235
Splenectomy for hemangiomatous endothelioma of spleen, *Feb.*, 235
  in hemolytic icterus, *Oct.*, 1316
    jaundice, *June*, 909
  in pernicious anemia, *Oct.*, 1314
  in primary polycythemia, *Oct.*, 1318
  in splenic anemia, *Oct.*, 1308
  in splenomyelogenous leukemia, *Oct.*, 1321
  in syphilitic splenic anemia, *Oct.*, 1310
  through combined low intercosto-abdominal incision, *Oct.*, 1437
  under local anesthesia, *Aug.*, 965
Splenic anemia, splenectomy in, *Oct.*, 1308
    syphilitic, splenectomy in, *Oct.*, 1310
  syndromes, *Oct.*, 1307
Splenomyelogenous leukemia, splenectomy in, *Oct.*, 1321
Split patella incision, *Oct.*, 1486
Spondylitis, traumatic, *Dec.*, 1581
    diagnosis, *Dec.*, 1583
    treatment, *Dec.*, 1585
Spontaneous gangrene, presenile, *Feb.*, 73
Sprue as probable cause of fatality in suppurative bronchiectasis, *Dec.*, 1550
Sputum, examination of, in abscess of lung, *June*, 769
Stab wound of brachial plexus, *April*, 562
Steapsin, *Feb.*, 10
Steatorrhea, *Feb.*, 10
Stenosis, pyloric, congenital hypertrophic, *June*, 797
    pyloroplasty in, *June*, 798–800
Sternoclavicular luxation, *June*, 885
Stewart incision in carcinoma of breast, *Feb.*, 185
Stoffel operation in treatment of spastic paralysis, *June*, 729, 731–733
Stomach, benign lesions, actual cautery in, *Oct.*, 1233
Stomach, cancer of, inoperable, jejunostomy as palliative measure in, case report, *Dec.*, 1619, 1627
  leather-bottle, *Aug.*, 1178, 1183
  penetrating ulcers of lesser curvature of, *Dec.*, 1563
      diagnosis, *Dec.*, 1564
      etiology, *Dec.*, 1563
      hour-glass formation in, *Dec.*, 1566
      operative procedure in, *Dec.*, 1570
      partial gastrectomy in, *Dec.*, 1569
      postoperative treatment, *Dec.*, 1572
      surgical treatment, *Dec.*, 1568
      symptoms, *Dec.*, 1564
      x-ray in diagnosis, *Dec.*, 1566
  pyloric end, cancer of, local anesthesia in operating for, *Aug.*, 945
  resection of, Murphy button in, *Dec.*, 1570
  syphilis of, *Aug.*, 1175
    prognosis, *Aug.*, 1184
    x-ray findings in, *Aug.*, 1182, 1183
  ulcer of, *June*, 908
    jejunostomy in, value of, case report, *Dec.*, 1619
Stone in kidney and chronic nephritis with anuria, *April*, 433
Stove-in chest, surgical treatment, *Oct.*, 1436
Stricture of rectum, *Aug.*, 1047, 1056
Stump, amputation, Hirsch's method of care, *Aug.*, 1149
    neuroma of, *June*, 903
    postoperative routine care, *Aug.*, 1149
Subcutaneous fat, use of, in peritoneal cavity, *Oct.*, 1469
Subdiaphragmatic abscess, operative treatment, *Oct.*, 1437
Suboccipital craniotomy and removal of arches of atlas and axis under local anesthesia, *Dec.*, 1695
Substernal thyroid enlargements, *Aug.*, 957
Substragalar arthrodesis, *Feb.*, 156
Suppression of urine, reflex, anuria and, *April*, 425
    due to impacted ureteral calculus requiring ureterotomy, *April*, 438
Suppurative bronchiectasis, single-stage lobectomy in, *Dec.*, 1541
  mastitis, chronic, *April*, 277
  pancreatitis, secondary, *Feb.*, 16, 20

Suprachiasmal tumors, operations for, *Oct.*, 1360
Surgical neuralgia, *Feb.*, 106
Suture material for use in transplantation of fat in peritoneal cavity, *Oct.*, 1469
  of musculospiral nerve, *April*, 339
  of ulnar nerve, *June*, 903
Swallowing of foreign bodies, *April*, 547
Sweating, blood, *April*, 341
Syme amputation, *June*, 711, 715
    factors essential for success of, *June*, 716
    merits of, *June*, 715
    permanent limb for, *June*, 728
    technic of operation, *June*, 717
    temporary peg-leg for, *June*, 726
Syndromes, splenic, *Oct.*, 1307
Synovitis, *Dec.*, 1601
  oxygen injection of knee-joint in, *Dec.*, 1601
  purulent, mild types, treatment, *Dec.*, 1604
    moderate types, treatment, *Dec.*, 1604
    severe types, treatment, *Dec.*, 1604
    types, *Dec.*, 1604
  treatment of, *Dec.*, 1602
Syphilis, non-union of tibia associated with, *Oct.*, 1498
  of stomach, *Aug.*, 1175
    prognosis, *Aug.*, 1184
    x-ray findings in, *Aug.*, 1182, 1183
Syphilitic effusion into both knees, *Feb.*, 179
  splenic anemia, splenectomy in, *Oct.*, 1310

TÆNIA echinococcus, *Feb.*, 41
Tarsal fracture, old, *June*, 888
Tarsus, transverse horizontal section of, *Feb.*, 156
  tuberculosis of, *June*, 906
Taylor's operation for cervical rib, *April*, 337
Tenderness in tumors of brain, *Oct.*, 1351
Tendon sheaths, palmar, tuberculosis of, *June*, 905
  surgery, *June*, 908
    active use of united tendons, *June*, 822
    bone injuries in, *June*, 820
    débridement in, *June*, 816
    examination before operation, *June*, 815
    massage in, *June*, 823
Tendon surgery, method of suture in, *June*, 813, 814, 815
    old healed cases, *June*, 819
      scar tissue in, *June*, 819
    recent cases, *June*, 819
    splinting and after-care, *June*, 821
    stitch for, *June*, 813
    suture material in, *June*, 818
    technic of operating, *June*, 816
    transplantation of tendon in, *June*, 820
Testicle, ectopic, perineal variety, implantation of testicle in scrotum for, *Feb.*, 231
  implantation of, in scrotum, for ectopic testicle, *Feb.*, 231
Testis, undescended, *June*, 910
Tests for pancreatic ferments, *Feb.*, 10
Tetanus antitoxin in multiple fractures of left upper extremities, *Dec.*, 1588
Thiersch skin-grafting, *Dec.*, 1650
    after-treatment, *Dec.*, 1662
    anesthetizing area in, *Dec.*, 1655
    placing of graft, *Dec.*, 1658
    preparation of surface for, *Dec.*, 1652
    silver foil dressing for, *Dec.*, 1662
    technic of cutting graft, *Dec.*, 1655
Thigh, amputation of, *Aug.*, 1113
    Krüger's method of treating nerves in, *Aug.*, 1147
    Ritter's method of treating nerves in, *Aug.*, 1146
    technic, *Aug.*, 1140
  and forearm, cellulitis of, *Feb.*, 173
Thoracic conditions, diagnosis, *Oct.*, 1443
    x-rays in diagnosis, *Oct.*, 1443
  fistula with chronic left empyema, major thoracoplasty and lung mobilization in, *Dec.*, 1551
  surgery, choice of anesthesia in *Oct.*, 1443
    developments and possibilities, *Oct.*, 1425
  wall, tumors of, surgical treatment, *Oct.*, 1436
Thoracoplasty, major, and lung mobilization in chronic left empyema with thoracic fistula, *Dec.*, 1551
Thorax, foreign bodies in, removal, *Oct.*, 1436
  gunshot wounds of, *Oct.*, 1426
  traumatic lesions of, surgical treatment, *Oct.*, 1436
Thrombo-angeitis obliterans, *Feb.*, 73

- Thrombosis, venous, after operation, *April*, 284
- Thymus gland, operations on, *Oct.*, 1437
- Thyroglossal tract, cysts of, *Oct.*, 1509
  - diagnosis, *Oct.*, 1509
  - treatment, *Oct.*, 1509
- Thyroid artery, inferior, Dequervain's method of ligating, *Aug.*, 981
    - ligation of, local anesthesia in, *Aug.*, 981
  - enlargements, substernal, *Aug.*, 957
  - malignant tumors of, *Oct.*, 1291
- Thyroidectomy, local anesthesia in, *Aug.*, 981
- Tibia, fracture of, open reduction for, *Feb.*, 135
  - non-union of, associated with syphilis, *Oct.*, 1498
  - osteomyelitis of, with tranrposition of fibula, *Aug.*, 1078
  - sarcoma of, *Dec.*, 1798
  - spine of, injury of, *Dec.*, 1613
    - treatment, *Dec.*, 1614
- Tic douloureux, *Feb.*, 101, 106. See also *Trigeminal neuralgia.*
- Tonsils, removal of, abscess of lung due to, *June*, 766
- Torticollis, acquired, *Aug.*, 1203
  - congenital, *Aug.*, 1203
- Transperitoneal cesarean section, *Aug.*, 1157
- Transplantation of fat in peritoneal cavity, *Oct.*, 1465
- Transverse colon, carcinoma of, symptomatology, *June*, 746
  - horizontal section of tarsus, *Feb.*, 156
- Trauma, relation of, to production of hernia, *Dec.*, 1574
- Traumatic(?) inguinal hernia, *Dec.*, 1573. See also *Inguinal hernia.*
  - lesions of chest, surgical treatment, *Oct.*, 1436
  - osteitis of wrist, *June*, 697
  - osteomyelitis, chronic, *Dec.*, 1773
  - paraplegia, laminectomy in lumbar region for, *Aug.*, 1185
  - spondylitis, *Dec.*, 1581
    - diagnosis, *Dec.*, 1583
    - treatment, *Dec.*, 1585
- Treitz, angle of, *April*, 506
  - ligament of, *April*, 506
- Trendelenburg posture, slight, after operations, *April*, 284
- Triangle of infection of pancreas, *Feb.*, 28
- Trigeminal nerve, function of, *Feb.*, 102
  - origin and distribution, *Feb.*, 101
- Trigeminal neuralgia, *Feb.*, 101
  - alcohol injections in, *Feb.*, 108, 117
  - etiology, *Feb.*, 107
  - forms of, *Feb.*, 103
  - operation for, *Feb.*, 110–114
    - complications after, *Feb.*, 116
    - end-results after, *Feb.*, 117
  - symptoms of, *Feb.*, 107
  - toxic, *Feb.*, 104
  - treatment, *Feb.*, 108
- Trypsin, *Feb.*, 10, 12
- Tuberculoma of brain, *Oct.*, 1350
- Tuberculosis of hip, *Aug.*, 1073
  - of knee, *June*, 655, 916
    - amputation of thigh for, *Aug.*, 1130
    - excision of knee in, *June*, 667
    - indications for amputation in, *Aug.*, 1136
    - operation for, *June*, 679
    - treatment, *June*, 679
  - of lymphatic vessels of leg and second metacarpal bone, *April*, 473
  - of mammary gland, *June*, 919
  - of palmar tendon sheaths, *June*, 905
  - of sacro-iliac joint, *June*, 703
    - arthrodesis for, *June*, 704
  - of spine, *Aug.*, 1076
  - of tarsus, *June*, 906
  - pulmonary, multiple resection of ribs with collapse of chest for, *Dec.*, 1557
  - renal, associated with renal calculus, *June*, 857
- Tuberculous fecal fistula, *Aug.*, 1047, 1054
  - osteitis of hip, *April*, 412
    - treatment, *April*, 413
  - pericarditis, primary, *Oct.*, 1411
    - abstract of 8 cases reported in literature since, 1897, 1420
    - case illustrating, *Oct.*, 1413
    - surgical treatment, *Oct.*, 1418
- Tumor, cerebellar, operations for, *Oct.*, 1359
  - cervical cord, with sensory manifestations, *Dec.*, 1699
    - laminectomy in, *Dec.*, 1700
  - cystic, of jaw, classification, *Feb.*, 257
  - extramedullary, at first dorsal segment, *Dec.*, 1705
    - laminectomy for, *Dec.*, 1706
  - malignant, of thyroid, *Oct.*, 1291
  - of brain, decompression in, *Oct.*, 1356, 1357
  - differential diagnosis, *Oct.* 1351

Tumor of brain, osteoplastic flap in operations for, *Oct.*, 1357
    pathology, *Oct.*, 1343
    radium in, *Oct.*, 1360
    surgical treatment, *Oct.*, 1356
        care after, *Oct.*, 1360
        end-results, *Oct.*, 1361
    symptoms, *Oct.*, 1350
    treatment, *Oct.*, 1343
    ventriculography in, *Oct.*, 1353
  of gasserian ganglion, *Oct.*, 1350
  of large intestine, *Aug.*, 1047
  of parotid gland, *Oct.*, 1515
      treatment, *Oct.*, 1516–1521
  of pituitary body, *Oct.*, 1350
  of thoracic wall, surgical treatment, *Oct.*, 1436
  suprachiasmal, operations for, *Oct.*, 1360
Tumor-forming osteitis deformans, *Feb.*, 57

Ulcer, duodenal, *April*, 273, 499
  gastric, actual cautery in, *Oct.*, 1233
    chronic, *April*, 367
  gastroduodenal, and diseased appendix, differential diagnosis, *April*, 534
  of stomach, *June*, 908
    jejunostomy in, value of, case report, *Dec.*, 1619
  peptic, *June*, 927
  perforating, of foot, *Aug.*, 1124
      amputation of thigh for, *Aug.*, 1113
      clinical picture, *Aug.*, 1124
      course, *Aug.*, 1124
      differential diagnosis, *Aug.*, 1128
      etiology, *Aug.*, 1124
      pathogenesis, *Aug.*, 1124
      prognosis, *Aug.*, 1128
      treatment, *Aug.*, 1128
Ulcers, penetrating, of lesser curvature of stomach, *Dec.*, 1563
        diagnosis, *Dec.*, 1564
        etiology, *Dec.*, 1563
        hour-glass formation in, *Dec.*, 1566
        operative procedure in, *Dec.*, 1570
        partial gastrectomy in, *Dec.*, 1569
        postoperative treatment, *Dec.*, 1572
        surgical treatment, *Dec.*, 1568
        symptoms, *Dec.*, 1564

Ulcers, penetrating, of lesser curvature of stomach, *x*-ray in diagnosis, *Dec.*, 1566
Ulnar nerve, suture of, *June*, 903
Umbilical fistula, *Aug.*, 1037
  hernia, *Feb.*, 161
Umbilicus, discharging, causes of, *Aug.*, 1044
  escape of retroperitoneal fluid from, *Aug.*, 1044
Undescended testis, *June*, 910
Urachus, patent, escape of urine or pus from, *Aug.*, 1044
Ureter, calculus in, with reflex anuria, *April*, 436
    with symptoms simulating intestinal obstruction, *April*, 424
  perforation of, *April*, 455
    with abscess, *April*, 459
Urinary extravasation, perirenal, *April*, 444
  lithiasis, complications of, *April*, 423
  tract, perforations of, *April*, 440
Urine, escape of, from patent urachus, *Aug.*, 1044
  pus in, in renal calculus, *June*, 838
  retroperitoneal, periureteral extravasation of, *April*, 450
  suppression of, reflex, anuria and, *April*, 425
      due to impacted ureteral calculus requiring ureterotomy, *April*, 438
Uterus, prolapse of, *Feb.*, 77
    analysis of symptoms, *Feb.*, 83
    complete, *Feb.*, 80
    partial, *Feb.*, 80
    type of operations for, *Feb.*, 85
  pseudoprolapse of, *Feb.*, 80

Vagina, artificial, method of constructing, *June*, 611
    operation, *June*, 612
Vaginal wall, posterior, hernia of, plastic operations for, *Feb.*, 90–100
Varix in Scarpa's triangle simulating femoral hernia, *Dec.*, 1673
      diagnosis, *Dec.*, 1677
      differential diagnosis from femoral hernia, *Dec.*, 1677
      operation in, *Dec.*, 1674, 1675
      symptoms, *Dec.*, 1673, 1675, 1676
Vater, ampulla of, *Feb.*, 8
Vault of skull, fracture of, *June*, 592

Venous thrombosis after operation, *April*, 284
Ventriculography in tumors of brain, *Oct.*, 1353
Virchow's disease, *Feb.*, 53
Visual disturbance in tumors of brain, *Oct.*, 1351
Vomiting in tumors of brain, *Oct.*, 1351
Von Recklinghausen's disease, *Feb.*, 57

Wirsung, duct of, *Feb.*, 2, 7
Wound, cholecystectomy, extraperitoneal drainage of, *Aug.*, 1197
  gunshot, of thorax, *Oct.*, 1426
  of brain, *June*, 913
  stab, of brachial plexus, *April*, 562
Wrist, traumatic osteitis of, *June*, 697
Wry-neck, acquired, *Aug.*, 1203
  congenital, *Aug.*, 1203
Wucherende Struma, *Oct.*, 1306

x-Ray burns, *Aug.*, 935
  findings in syphilis of stomach, *Aug.*, 1182, 1183
  in cancer of lower end of esophagus, *Dec.*, 1734
  in diagnosis of renal calculus, *June*, 839
    of thoracic conditions, *Oct.*, 1443
  in Hodgkin's disease, *Oct.*, 1327
  in treatment of sarcoma after excision, *Dec.*, 1800

Zygometer, *Feb.*, 122, 123

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